P 101, Nautical Astronomy.

MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

VOL. XXI. *Feb.* 8, 1861. No. 4.

THE Annual General Meeting of the Society, Rev. R. MAIN, President, in the Chair.

Edward Brailsford Bright, Esq., 2 Exchange Buildings, Liverpool;
Joseph Beck, Esq., Coleman Street;
Richard Inwards, Esq., 18 Albert Street, Camden Road;
James Symmers, Esq., Dollar;
Rev. Edward Frimstone, Winchester;
Samuel Mason, Esq., Redhill, Reigate; and
Joseph Bonomi, Esq., 5 A Portsdown Road, Maida Hill,

were balloted for and duly elected Fellows of the Society.

At the Meeting in January, James Lees Kenworthy, Esq., The Park, Ealing, was balloted for and duly elected a Fellow of the Society.

Report of the Council to the Forty-first Annual General Meeting of the Society.

The year on which the Council now report has not, perhaps, been marked by any occurrence of the first order of importance.

Nevertheless, it will be found to have done its part towards the progress of the science; those useful labours which are always preparing great results have been sedulously pursued.

The Report of the Auditors, subjoined, will show the state of the finances:—

RECEIPTS.

	£	s.	d.
Balance of last year's account	264	15	7
By dividend on £1900 Consols	26	19	2
By ditto on £3500 new 3 per Cents	101	14	5
By ditto on £2000 Consols	28	15	0
By cash of East India Government	75	0	0
On account of arrears of contributions	111	6	0
128 contributions (1860–61)	268	16	0
7 compositions	147	0	0
21 admission-fees	44	2	0
14 first year's contributions	26	5	0
2 contributions for 1862	4	4	0
1 contribution overpaid (to 1862)	1	1	0
Sale of Publications	67	5	0
	£1167	3	2

EXPENDITURE.

	£	s.	d.	£	s.	d.
Salaries:—						
Mr. Cayley, 1 year as Editor of the Society's Publications	60	0	0			
Mr. Williams, 1 year as Assistant-Secretary	100	0	0			
Ditto commission on collecting £522 19s.	26	3	0			
				186	3	0
Investments:—						
Investing £100 3 per Cent Consols				94	7	6
Taxes:—						
Property Tax, 1 year	1	17	6			
Assessed and Land, ditto	3	2	6			
				5	0	0
Bills:—						
J. Basire, engraver	3	1	3			
Troughton and Simms	5	17	0			
Geo. Barclay, printer	355	6	0			
Strangeways and Co., printers	75	6	6			
Smith and Co., engravers	4	2	6			
Malby and Son, lithographers	14	15	0			
J. Rumfit, bookbinder	7	11	0			
J. Taylor, matting	3	15	9			
Willis, dinner	3	10	0			
Mrs. Jones (Lee Fund)	3	5	6			
				476	10	6
Carried forward				£762	1	0

	£	s.	d.	£	s.	d.
Brought forward				762	1	0
Miscellaneous items:—						
Charges on books, and carriage of parcels ...	4	13	9			
Postage of *Monthly Notices*, letters, &c.	42	8	0			
Porter's and charwoman's work	23	18	9			
Tea, sugar, biscuits, &c. for evening meetings	13	13	0			
Waiters attending meetings	3	17	0			
Coals, &c.	12	0	0			
Sundry disbursements by the Treasurer	26	1	8			
Sundry payments out of Turnor Fund	1	9	6			
Deduction on country cheque	0	1	3			
				128	2	11
Balance at Banker's				276	19	3
				£1167	3	2

Assets and present property of the Society, Feb. 8, 1861:—

	£	s.	d.	£	s.	d.
Balance at Banker's				276	19	3
4 contributions of 3 years' standing	25	4	0			
21 ——— of 2 ditto	88	4	0			
17 ——— of 1 ditto	35	14	0			
On account of arrears	6	0	0			
				152	2	0
Due for publications of the Society				1	9	0

£3500 new 3 per Cents.
£2000 Consols (including the Lee Fund).
Unsold publications of the Society.
Various astronomical instruments, books, prints, &c.

Balance of Turnor Fund (included in Treasurer's account) ...	45	3	4			

The Fellows will doubtless remark that the expenses of printing have increased to an extent which, unless some measures of retrenchment be adopted, may soon lead to a diminution of the capital of the Society. The new Council will, beyond a doubt, give this matter the most serious consideration. Since there can be no doubt that the quantity which may be printed with advantage to the cause will increase, and not diminish, it is clear that the savings of the Society must not be permanently relied on, beyond the income they produce. Hitherto, there has been found no necessity to refuse printed circulation to any matter of even moderate importance, but it is to be feared that the time is near at hand when, unless the Society should continue rapidly to increase in numbers, communications of real value must be either rejected or prejudicially abridged. The Council think it right to make this communication at the earliest moment, and while it is a matter of prediction, not of experience.

Stock of volumes of the *Memoirs*:—

Vol.	Total.	Vol.	Total.	Vol.	Total.
I. Part 1	27	IX.	193	XXI. Part 1 (separate).	204
I. Part 2	69	X.	205	XXI. Part 2 (separate).	100
II. Part 1	86	XI.	216	XXI. (together).	122
II. Part 2	51	XII.	222	XXII.	217
III. Part 1	111	XIII.	240	XXIII.	217
III. Part 2	130	XIV.	223	XXIV.	229
IV. Part 1	126	XV.	207	XXV.	235
IV. Part 2	139	XVI.	228	XXVI.	251
V.	159	XVII.	207	XXVII.	510
VI.	179	XVIII.	207	XXVIII.	478
VII.	202	XIX.	220		
VIII.	188	XX.	216		

Progress and present state of the Society:—

	Compounders.	Annual Contributors.	Non-residents.	Patroness, and Honorary.	Total Fellows.	Associates.	Grand Total.
February 1860 ...	155	193	32	4	384	51	435
Since elected	8	21	...	...	...	...	...
Deceased	−3	−3	−1	...	...	...	...
Resigned	...	−1	...	...	...	...	...
Removal	1	−2	...	...	...	...	...
Name removed for non-payment of admission fee, &c.	...	−1	...	...	...	...	...
February 1861 ...	161	207	31	4	403	51	454

The instruments belonging to the Society are as follows:—

The *Harrison* clock,
The *Owen* portable circle,
The *Beaufoy* circle,
The *Beaufoy* transit,
The *Herschelian* 7-foot telescope,
The *Greig* universal instrument,

The *Smeaton* equatoreal,
The *Cavendish* apparatus,
The 7-foot Gregorian telescope (late Mr. Shearman's),
The Variation transit (late Mr. Shearman's),
The Universal quadrant by Abraham Sharp,
The *Fuller* theodolite,
The Standard scale,
The *Beaufoy* clock,
The *Wollaston* telescope,
The *Lee* circle.

The *Sheepshanks'* collection of instruments, viz.,—

1. 30-inch transit, by Simms, with level and two iron stands.

2. 6-inch transit theodolite, with circles divided on silver; reading microscopes, both for altitude and azimuth; cross and siding levels; magnetic needle; plumbline; portable clamping foot and tripod stand.

3. $4\frac{6}{10}$ achromatic telescope, about 5 feet 6 inches focal length; finder, rack motion; double-image micrometer; object-glass micrometer; two other micrometers; one terrestrial and ten astronomical eyepieces, applied by means of two adapters.

4. $3\frac{1}{4}$-inch achromatic telescope, with equatoreal stand; double-image micrometer; one terrestrial and three astronomical eyepieces.

5. $2\frac{3}{4}$-inch achromatic telescope, with stand; one terrestrial and three astronomical eyepieces.

6. $2\frac{3}{4}$ achromatic telescope, about 30 inches focus; one terrestrial and four astronomical eyepieces.

7. 2-foot navy telescope.

8. 45-inch transit instrument, with iron stand, and also Y's for fixing to stone piers; two axis levels.

9. Repeating theodolite, by Ertel, with folding tripod stand.

10. 8-inch pillar-sextant, divided on platinum, with counterpoise stand and horizon roof.

11. Portable zenith instrument, with detached micrometer and eyepiece.

12. 18-inch Borda's repeating circle, by Troughton.

13. 8-inch vertical repeating circle, with diagonal telescope, by Troughton and Simms.

14. A set of surveying instruments, consisting of a 12-inch theodolite for horizontal angles only, with extra pair of parallel plates; tripod staff; in which the telescope tube is packed; repeating table; level collimator, with micrometer eyepiece; and Troughton's levelling staff.

15. Level collimator, plain diaphragm.

16. 10-inch reflecting circle, by Troughton, with counterpoise stand; artificial horizon, with metallic roof; two tripod stands, one with table for artificial horizon.

17. Hassler's reflecting circle, by Troughton, with counterpoise stand.
18. 6-inch reflecting circle, by Troughton, with two counterpoise stands, one with artificial horizon.
19. 5-inch reflecting circle, by Lenoir.
20. Reflecting circle, by Jecker, of Paris.
21. Box sextant and 3-inch plane artificial horizon.
22. Prismatic compass.
23. Mountain barometer.
24. Prismatic compass.
25. 5-inch compass.
26. Dipping needle.
27. Intensity needle.
28. Ditto ditto.
29. Box of magnetic apparatus.
30. Hassler's reflecting circle, with artificial horizon roof.
31. Box sextant and $2\frac{1}{4}$-inch glass plane artificial horizon.
32. Plane speculum artificial horizon and stand.
33. $2\frac{1}{2}$-inch circular level horizon, by Dollond.
34. Artificial horizon roof and trough.
35. Set of drawing instruments, consisting of 6-inch circular protractor; common ditto; 2-foot plotting scale; two beam compasses and small T square.
36. A pentagraph.
37. A noddy.
38. A small Galilean telescope, with the object lens of rock-crystal.
39. Six levels, various.
40. 18-inch celestial globe.
41. Varley stand for telescope.
42. Thermometer.

These are now in the apartments of the Society, with the exception of the following, which are lent, during the pleasure of the Council, to the several parties under mentioned, viz.:—

The *Wollaston* telescope, to Mr. Rees.
The *Lee* circle, to Mr. Burr.
The *Beaufoy* clock, to Dr. Booth.

The *Sheepshanks* instrument, No. 1, to Mr. Lassell.
Ditto ditto No. 2, to Mr. De La Rue.
Ditto ditto No. 3, to Rev. C. Pritchard.
Ditto ditto No. 4, to Mr. Carrington.
Ditto ditto No. 5, to Mr. Birt.
Ditto ditto No. 6, to Rev. J. Cape.
Ditto ditto No. 8, to Prof. Wheatstone.
Ditto ditto No. 19, to Mr. Dayman.
Ditto ditto No. 25, to ditto.

The *Sheepshanks* instrument, No. 41, to Rev. C. Pritchard.
Ditto ditto No. 10, to Rev. C. Pritchard.
The double-image micrometer, to Mr. Hodgson.
The *Sheepshanks* instrument, No. 23, to Mr. Spottiswoode.
The 6-inch circular protractor, to Mr. Birt.

Nothing definite has yet been ascertained respecting the other *Beaufoy* clock, the two invariable pendulums, and the quadrant (said to have been *Lacaille's*), reported for many years past as being in the possession of the Royal Society.

A telescope belonging to the late Rev. R. Sheepshanks, found in the stock of Mr. Simms, has been added to the collection by Miss Sheepshanks.

The Council have awarded the Gold Medal to M. Goldschmidt of Paris, for his astronomical labours, especially for those which have resulted in the discovery of 13 of the Minor Planets. The President will explain the grounds of this award before the Meeting closes.

The twenty-ninth volume of the *Memoirs* of the Society has almost the whole of it passed through the press, and will shortly be ready for publication. It contains more than the usual number of papers, some of them of great importance. The first is a paper by the Astronomer Royal, giving the corrections of the elements of the Moon's orbit, deduced from the lunar observations made at the Royal Observatory at Greenwich from 1750 to 1851; being the extension of a preceding memoir based upon the observations from 1750 to 1830. The year 1851 was fixed on as the definitive limit of the reductions, partly by reason that the date of publication of Mr. Adams's researches on the lunar parallax enabled the use of a corrected parallax in the daily reductions from the beginning of 1852, partly because it was known that Prof. Hansen's tables were advancing, and would probably be ready for adoption in the *Nautical Almanac* at no distant time. The Council cannot but congratulate the Fellows of the Society on the publication in their *Memoirs* of a paper containing the completion of the results deduced from such a series of observations.

Captain Clark has contributed a memoir on the Figure of the Earth, undertaken in reference to the investigations in General T. F. de Schubert's "Essai d'une Détermination de la véritable Figure de la Terre." Whatever the real figure of the Earth may be, if in the investigation it is taken to be an ellipsoid, it is clear that the arithmetical process must bring out an ellipsoid of some kind or other, agreeing better with all the observed latitudes, as a whole, than any spheroid of revolution will do. And although it cannot be said that the Earth is thereby *proved* not to be a spheroid of revolution—

the data being in fact insufficient for this purpose—it is in the meantime interesting to ascertain what ellipsoid does actually best represent the existing measurements. This investigation is accordingly undertaken in the memoir, and the dimensions of the axes, and position in longitude of the equatoreal major axis, together with the probable errors of these quantities, are obtained; it appears, however, from the magnitude of the probable errors that the data are not sufficient to bring out the excentricity of the equator with anything like certainty.

Mr. William Ellis has contributed a paper on the Periodical Variations of Level and Azimuth of the Transit Circle at the Royal Observatory, Greenwich. The tables and diagrams bring out very clearly the character of the periodical variations, depending chiefly on the temperature, to which the instrument is subject.

Sir Thomas Maclear has communicated the Observations of Donati's Comet, made at the Royal Observatory, Cape of Good Hope, between October 11th, 1858, and March 14th, 1859. Observations for orbit were the primary consideration, and two series were made, one by Mr. Mann, with the $8\frac{1}{2}$-feet equatoreal, comprising the whole interval of visibility, the other with the 46-inch telescope by the Director himself and G. W. H. Maclear conjointly, in October and November as long as the observations with that instrument were practicable.

Lord Wrottesley has communicated a Catalogue of the Positions and Distances of 398 Double Stars; the result of observations made at the Observatory at Wrottesley by his assistants, Messrs. Simms, Philpot, and Frederick Morton, but the far greater part of them since the beginning of the year 1854 by Mr. Frederick Morton. The working catalogue of stars for observation was selected from Struve's great catalogue of 1837; and contained, 1°, stars confessedly binary; 2°, others of which there was strong presumptive evidence of their being so; 3°, stars of which the observations by different observers gave anomalous or discordant results. As these objects were worked out, more were added from time to time from among the finer and closer of the double stars, and from those which had only been observed at one epoch; some of these latter exhibit orbital motion.

The President has contributed a paper on the Value of the Constant of Aberration, as deduced from Eight Years' Observations of *γ Draconis*, made with the Reflex Zenith Tube, at the Royal Observatory, Greenwich, which may be considered as a supplement to his paper in the twenty-fourth volume of the *Memoirs*, on the Values of the Constants of Aberration and Nutation, as deduced from the observations of the same star with the 25-foot zenith-tube, dismounted in the year 1842. The resulting value of the constant of aberration is very nearly $20''.34$, and the author considers that considerable credit is due to this determination. There is, however, as in the former series

of observations, a negative value of the parallax; being in the present series $-0''.24$, which is ten times as great as the probable error, and is therefore an indication of something having affected the observations injuriously, although not to so large an amount as in the case of the 25-foot zenith-tube.

Mr. Cayley has contributed two papers. The first of them, Tables of Developments of Functions in the Theory of Elliptic Motion, contains the developments in multiple cosines and sines of the mean anomaly as far as e^7, of certain powers of the elliptic quotient radius $\frac{r}{a}$, or of its variable part $\left(\frac{r}{a} - 1\right)$, multiplied in either case by a cosine or sine of a multiple of the true anomaly. The tables are based upon a formula given by M. Le Verrier, and were calculated under Mr. Cayley's superintendence, by Messrs. Creedy and Davis, by aid of a grant from the Donation Fund at the disposal of the Council of the Royal Society.

The second of the two papers is on the Rotation of a Solid Body, and contains an investigation of the formulæ for the variation of the elements in the disturbed motion, by a method similar to that employed in the author's memoir on the Theory of Disturbed Elliptic Motion, published in the twenty-seventh volume of the *Memoirs*. The author calls attention in the paper to the employment of the quantity g varying uniformly with the time but used as an element, and which corresponds to the mean anomaly in the theory of elliptic motion.

The volume contains also a paper by Mr. Spottiswoode, on a Method of Determining Longitude by means of Observations of the Moon's greatest Altitude; intended to suggest a method whereby at certain parts of the Moon's orbit and under favourable circumstances, the longitude may be obtained by means of a simple sextant observation. Although not so accurate as some others already in use, and restricted as to the times at which it is applicable, it was thought that a method in which both observation and calculation are simple, might not be without use either as supplementary to more elaborate processes, or as a substitute for them when they are not practicable, and the method in the memoir is suggested in that view.

The concluding paper in the volume is one by Mr. Carrington, on the Distribution of the Perihelia of the Parabolic and Hyperbolic Comets in relation to the Motion of the Solar System in Space. If the Solar System be moving in the direction from α *Columbæ* to π and μ *Herculis*, there ought then, if such Comets are chance visitors, to be an excess of perihelia in the hemisphere of which α *Columbæ* is the pole, or computing for each orbit the angle between α *Columbæ* and the perihelion, the mean of these angles should be less than 90°. It appears, however, by the tables which are given, that the mean of the angles for the 133 orbits considered is in fact 95° 36′; the author remarks that this is a result which superior evidence compels us to regard as

nugatory and vitiated by uncontrolled conditions, among which the principal is probably the unequal distribution of observers in the northern and southern hemispheres.

An elaborate paper by Sir J. W. Lubbock, on the Lunar Theory, will probably be printed in the thirtieth volume of the *Memoirs*. The paper relates chiefly to the correction of the numerical values of the coefficients of the different lunar inequalities; but it contains also an investigation sustaining Prof. Adams' value of the controverted term $\left(\frac{3771}{64} m^4 e'^2\right)$ in the expression for the acceleration, and some other theoretical investigations.

The Council regret the loss by death of the following members:—Sir W. Dennison; John Hamilton, Esq.; J. W. Long, Esq.; Charles May, Esq.; Rev. Baden Powell; William Simms, Esq.; and of a late member, Professor Narrien.

The following account of Sir Thomas Brisbane could not be prepared in time for the last Annual Report, the news of the death of its lamented subject being then quite recent.

General Sir Thomas Makdougall Brisbane, Baronet, &c., was of an ancient family, and was born in August 1773; he died January 28th, 1860, in his eighty-seventh year. It is totally impossible to enter upon his career and services. The following abstract is substantially extracted from a publication made by his family:—

Sir Thomas entered the army in 1790, and fought in the first battle of the war, in May 1793, and in the subsequent actions. He went to the West Indies in 1796, and was present at the taking of all the islands under General Sir Ralph Abercromby. He went to the Peninsula in 1812, and commanded a brigade in six general actions, under the Duke of Wellington. He fought in fourteen general actions and twenty-three great affairs, and assisted at eight sieges. He crossed the tropics twelve times, the equinoctial twice, circumnavigated the globe, was in North America, South America, the North of Europe, the Mediterranean, and Australia. In the winter of 1794 he slept for six nights in the snow, with nothing but his cloak and the canopy of heaven over him: he was frozen to the ground in the morning, and during one of these nights 900 soldiers were frozen to death. He was the oldest officer in the army, as he had sixty-nine years of military service.

Sir Thomas Brisbane's devotion to Astronomy began, according to his own account, during his voyage to the West Indies, when the incidents of a gale of wind made him alive to the great use of which navigation and nautical astronomy might be, even to a military man. When in the Peninsula, he regularly found the time by a pocket-sextant, chronometer, and artificial horizon.

During the time he spent in Paris, from 1815 to 1818, with the army of occupation, Sir Thomas Brisbane was instrumental in preventing a rabble of German soldiers from pulling down the buildings of the Academy of Sciences, and in grateful testimony of his services he was thereupon elected a corresponding Member of the Institute.

Sir Thomas Brisbane married in the year 1819 the eldest daughter of Sir Henry Hay Macdougall, Bart., of Makerstoun; through whom he became entitled to the estate of Makerstoun, near Kelso, in addition to his own paternal property of Brisbane.

When the question of sending Sir Thomas to the Government of New South Wales was before the Ministry, Lord Bathurst informed the Duke of Wellington that he wanted a man to govern, not the heavens, but the earth. Sir Thomas appealed to the Duke to say whether science had ever stood in the way of duty. "Certainly not," said the Duke; "I shall say that you were never in one instance absent or late, morning, noon, or night; and that, in addition, you kept the time of the army." Walter Scott wrote of him, that though full of science, he bored no one with it, and was full of general information.

Sir Thomas Brisbane founded three Observatories: one in his public capacity, at Paramatta; two on his own property, at Brisbane and at Makerstoun: at which last place he also founded a magnetic Observatory. In 1828 he received our Gold Medal for his series of observations at Paramatta. The address delivered by Sir John Herschel on its presentation renders it unnecessary to say more at this time.

Brisbane passed his long life without the smallest stain—without even an official mishap. Sound judgment and high principle carried him triumphantly through all the difficulties which lie in the way of the soldier and the administrator: his manners must have not a little contributed to his success. It has been absurdly said that a gentleman, to be the perfection of the character, must not bear the stamp either of his country or of his profession: General Makdougall Brisbane was a refutation of both the points of the assertion; for though in the first five minutes he would have been detected as a Scotchman and a soldier, even though his name and title were unknown, he would in as short a time have been known for a gentleman of the highest breeding; and further acquaintance would have proved that the first appearances were not deceitful.

In estimating the scientific character of Sir Thomas Brisbane, we must distinguish between his claims as an able observer and astronomer in his own person, and as a munificent patron and promoter of science. In the former capacity he takes a high rank, and his acquirements were remarkable. He was a good observer with the sextant, and well versed in every part of nautical astronomy generally, so as to be able to fix

the position of every station at which he might happen to be during his military campaigns. He was also well acquainted with the instruments used in fixed observatories, and was himself a good transit-observer. But it is as a patron of science, by the institution of Observatories, and the encouragement and promotion of Astronomy at a time when its needs were greater and the interest taken in it less than they are at present, that his claims on posterity must be based. The institution of the Brisbane Observatory at Paramatta was a noble work, notwithstanding that, from a variety of causes over which he had no control, the results have been in a great measure nugatory. The chief fault seems to have been in the unsteadiness of the transit-instrument, which has made the results of this Catalogue of Stars in a great degree useless; and it is unnecessary, at this interval of time, to try to determine the degree of blame attributable to individuals. It is, however, greatly to be regretted that the operations of an Observatory so important should not have produced results better calculated to repay its founder.

A similar disappointment did not, however, occur in the magnetical and meteorological Observatory which he established at Makerstoun, in addition to the astronomical Observatory already existing. Sir Thomas was fortunate in his choice of observers, and the results have been of considerable importance. For several years the magnetical observations were most ably conducted by Mr. J. A. Broun, who has since become the Astronomer of the Rajah of Travancore; and several papers on magnetism, in addition to the daily work of the observatory, are evidences of the talents and industry of that gentleman.

We may say, indeed, in summing up the claims of this accomplished gentleman and munificent patron of science to the gratitude and admiration of posterity, that they do not depend in any great degree on the absolute success which has attended his efforts. He saw much more clearly than his contemporaries the need of a well-equipped Observatory in the Southern Hemisphere, and he not only built one at his own expense and provided observers, but he used the influence which his position in the colony of New South Wales gave him to diffuse a taste for astronomical science. In a similar way, when co-operation was needed for the determination of magnetical and meteorological elements, he as freely gave his time and his money for the establishment of an Observatory at Makerstoun, and with the best possible results in the latter case. A rigorous sense of duty seems to have been the guiding principle of his long life of activity and usefulness—the duty of using all his advantages for the good of society and for the extension of science; and he has left behind him a name second to few even in this age so prolific in great and noble characters.

Mr. Isaac Long was born in May 1810, and died at Alderly Lodge, Cheshire, May 29, 1860. His father's misfortunes obliged him to maintain himself before his education was completed. While acquiring a handsome independence by long attention to business, he obtained good knowledge of several sciences. He was an industrious observer of the heavens with a 5-inch achromatic telescope equatoreally mounted, and was the first to call attention to some remarkable changes in *Jupiter's* belts. He was an expert photographer, and made a fine collection of geological specimens. He was an active member of local societies, and aided with zeal in the dissemination of scientific knowledge. One of the best features of progress in our time is the number of these men who, while succeeding in mercantile life, are actual labourers in literature and science.

Charles May, F.R.S., was born at Alton in Hampshire, in the year 1800, and at an early age, along with the rest of his father's family, he removed to Ampthill in Bedfordshire. His father belonged to the Society of Friends; his education was of a very limited character, scarcely superior to that of the children of ordinary mechanics of the present day, but the mechanical genius for which he afterwards became so distinguished, began to develope itself at a very early period.

At the usual age he was apprenticed to Mr. Sims, a chemist and druggist at Stockport, whose daughter he afterwards married. At the expiration of his apprenticeship Mr. May returned to Ampthill, where he commenced business on his own account, adding to the ordinary retail business that of a manufacturing chemist on a small scale. He afterwards added a new branch to his business, that of a millwright, the special object being to furnish the requisite machinery for the drug-mills, which, in conjunction with Mr. Stafford Allen, he established in Cowper Street, City Road.

At this period Astronomy became one of his favourite pursuits, and he constructed with his own hands several reflecting telescopes of excellent performance; and although the engrossing nature of his other duties never allowed him to devote much time to practical astronomy, he retained through life a warm attachment to the science.

In the year 1836, Messrs. Ransome of Ipswich, who had for many years carried on the business of agricultural implement-makers, offered him a partnership in their concern, which he accepted, giving up at the same time his other business engagements. Mr. May's department in these works was the *engineering*, and under his vigorous management the concern rapidly grew from a small implement-factory employing about 100 hands to a large engineering establishment known all over the world, and employing 12 or 1300 persons. He remained at Ipswich until the year 1851, when he and Messrs. Ransome

dissolved partnership. He then removed to London and practised as a consulting engineer until his death. Whilst at Ipswich he constructed for the Astronomer Royal the great Transit-Circle and the Altazimuth. These magnificent instruments are justly regarded by all competent judges as models of engineering perfection, and they have inaugurated a new phase in astronomical-instrument-making. Mr. Airy, in one of his Annual Reports to the Board of Visitors, bears willing and grateful testimony to the zeal and ability with which Mr. May carried out his own splendid conceptions.

During his residence at Ipswich Mr. May erected a very elegant and spacious private Observatory, furnished with a transit instrument, clock, and a Merz achromatic telescope of exquisite quality, with an object-glass of $6\frac{1}{3}$ inches aperture. He also constructed the dome at Hartwell House, which covers the telescope formerly belonging to Admiral Smyth, another large dome for Mr. Barclay of Bury Hill, and the equatoreal mounting for the great object-glass of Ross, which graced the memorable Exhibition of 1851, and formed so conspicuous an object in the nave of the palace of glass.

He also distinguished himself by his improvements in the "permanent way" of railways, and was the first to suggest the application of the process termed "chilling" to the pivots of large instruments. He was the inventor of "compressed treenails" for fastening railway-chairs to the sleepers.

Such was Mr. May in his professional capacity. In private life his amiable disposition and the combination of kindness and humour which he brought to social intercourse, and his readiness to assist others, made him generally beloved. He became a member of this Society in 1835, and served several times on the Council. He was elected a Fellow of the Royal Society in June 1855, and was also a member of the Institute of Civil Engineers. He died suddenly in August last, and few men have gone to the grave more deeply regretted than Charles May.

The late Professor Narrien, of Sandhurst, had retired from the Society, in consequence of ill health, in the year 1858. The Council have not been able to procure any account of his life. He was for many years attached to the Royal Military College, where he was greatly respected and very useful. His name will be preserved by his *Historical Account of the Origin and Progress of Astronomy*, published in 1833. This work, founded on the study of original sources, is an attempt to connect the history of the science with its first elements. It is chiefly devoted to the ancient and middle periods, not extending in detail beyond the time of Newton. There is not, we believe, another work, so nearly popular in its character and appearance, which gives so exact an account of ancient Astronomy. It is a valuable predecessor, both in time and contents, to

the work of Mr. Grant. Mr. Narrien also published some elementary works on mathematics, as part of a course intended for the use of the College in which he taught.

The Rev. Baden Powell, F.R.S., was the eldest son of the late Rev. Baden Powell, of Langton in Kent, and was born at Stamford Hill, near London, in 1796. He graduated at Oxford, where he took a first-class degree in mathematics in 1817. In 1820 he entered into holy orders, and in the following year obtained the vicarage of Plumstead in Kent. He was appointed Savilian Professor of Geometry in 1827, and Public Examiner soon afterwards; a post with which he was again honoured in 1831. He thus stood, as it were, the acknowledged representative of mathematical and physical science in the elder English University. We may almost say the only representative; for when he first obtained the professorship, science was at the lowest ebb in Oxford. Mr. Powell exerted himself to bring this state of things before the educated world, by which he incurred some obloquy. But he persevered, and succeeded; the honourable position which Oxford now holds, and the bright prospects of the future, are due in good part to the exposure and remonstrance of the Savilian Professor.

He performed the duties of his chair with urbanity, seeking to encourage his students by explaining and familiarising each point that would allow of it; towards which he had a happy talent of constructing his own models, of the simplest materials, for his practical illustrations. Thus, whenever requested to deliver lectures at public institutions, he came armed with appropriate diagrams and forms that essentially aided the comprehension of those who crowded to hear him. We have thus seen the Undulatory theory of Light treated, and Diffraction made—we may say—palpable. The Precession of the Equinoxes, and the phenomena of Aberration and Nutation, were rendered equally visible; and the hurried progress of Comets when approaching the perihelion, was so attractively shown, that the audience flocked down, after the lecture, to watch the comet vary its speed through its long ellipse towards the sun. His style of delivery was peculiarly quiet, showing his own clear conviction and comprehension of his subject; and his calmness was caused by depth of thought. This sedateness of manner pervaded all his writings and discourses, enabling him even to preach extempore on the most intricate doctrinal points without wandering from his subject.

Meanwhile he had produced various works, as well scientific as theological. Among the first class may be cited his *Treatise on the Differential and Integral Calculus;* and another on the *Geometry of Curves.* In 1834 he published his *History of Natural Philosophy*, and in 1841 the *Undulatory Theory of Light;* besides which he was the author of several papers in the *Philosophical Transactions* on Light, Heat, and

Irradiation. Moreover, his tracts appear in the records of this Society, the Ashmolean collections, and the volumes of the British Association. In the other order of his writings we have to enumerate—besides those for the elucidation of pure religion—the *Connection of Natural and Divine Truth*, 1838; the *Unity of Worlds*, 1855; *Christianity without Judaism*, 1857; on the *Study of the Evidences of Christianity*, 1860, &c.

During the last years of his life Mr. Powell was a controversial theologian. His writings were of a cast which is called liberal by all, but by some in one sense, by some in another. The freedom of his criticism could not but provoke strong attack from his opponents. Of the controversy this Society can take no cognisance, but it must be remarked, as a mere matter of biography, that in his assault upon some modes of theological thought, to which the university once appeared unalterably given, Mr. Powell seems to have been as much of a precursor as in his efforts to stimulate science. The last of his writings appears as one of seven *Essays and Reviews*, most of his colleagues being Oxford men; and the whole of this work, which is in its fourth edition, shows that Oxford names of no mean note are now pledged to admit that freedom of examination which brought so much assault upon the isolated individual who first used it while actually connected with the university. Every meeting of educated men will contain those of the most opposite views as to his conclusions; but all will admire the fearless manner in which, without reference to his own interests, he spoke out the conclusions of his mind.

In the year 1850 Baden Powell was appointed one of the Government Committee of inquiry into the studies enjoined in Oxford; he being well known as an ardent educational reformer, a fact pretty well evinced in his tract on "State Education," considered with reference to "prevalent misconceptions on religious grounds." In 1854 he was selected, at Aberdeen, one of the three judges to award the valuable Theological Burnett Prizes in that city. Nor was the range of his capacity confined to argumentative studies only; for he not only possessed a large fund of general information, but was also a proficient in painting, and was well practised in the choral harmonies of church music, in which science he was a strong amateur.

The Professor's lamented death, on the 11th of last June, was the result of an attack on the lungs which commenced in the previous winter. He had been duly warned of his danger by his medical friends and attendants, several weeks before he expired; but he was resigned to the last, his only uneasiness being a difficulty of breathing, which, after a few days of extreme debility, terminated his existence. He died at his house in Stanhope Street, Hyde Park Gardens, at the age of 63, having scarcely ever been ill before. He was three times

married, and leaves a numerous family. His widow is the daughter of his and our colleague, Admiral Smyth.

Mr. Powell was for years on the Council of this Society, a regular attendant, and a zealous co-operator.

William Simms was born on Dec. 7th, 1793, at Birmingham, he was brought to London by his parents at a very early age, and when fourteen years old was apprenticed to Mr. Bennet, of Charles Street, Hatton Garden, one of the best "Chamber Masters" of that period, and who was originally a pupil of Ramsden.

Having served his time to the satisfaction of his master, and with credit to himself, he then commenced business as a mathematical instrument-maker at Bowman's Buildings, Aldersgate Street, in the City of London.

He was early connected with the Society of Arts, and became acquainted with several of its most eminent members, in consequence of the exhibition of a peculiar protractor of his own contrivance. This led to his introduction to the late Francis Baily, Esq., and Bryan Donkin, and through the latter to Col. Colby, then Superintendent of the Ordnance Survey.

Col. Colby was at that time in want of some large theodolites, and trusting to the representations of the friends of Mr. Simms as to his capabilities, was induced to give him an order. These instruments were completed so much to the satisfaction of the Colonel that other orders soon followed, and a large business speedily became the result.

Mr. Simms joined Troughton in 1826, and after a partnership of five years (Mr. Troughton retiring) carried on the business until his death.

He became a Fellow of the Royal Astronomical Society in 1831, and of the Royal Society in 1852.

He died at his residence at Carshalton on the 21st of June, 1860, and was buried in his family grave at Norwood Cemetery. The works of Mr. Simms are too numerous to be described here, most of them are well known, and accounts of some are to be found in the Memoirs of the Society.

By his connexion with Troughton Mr. Simms could not but acquire a well-known name; but it must be remembered that he was possessed of great skill and ability, and was not unworthy to be associated with his celebrated partner. The Cambridge Mural Circle, and the whole of the instrument-maker's part of the Greenwich Altazimuth, Transit-Circle, Reflex Zenith Tube, and Great Equatoreal, with many other instruments of repute, were the work of Mr. Simms. The admirable 8-inch object-glass of the Greenwich Transit-Circle also was ground by him. His improvements in the graduation of instruments were in some cases so much the work of time as to be hardly capable of being signalised as improvements at any one moment. By his self-acting dividing machine he

reduced the work of weeks to the work of hours, as well as improved the accuracy of the process, and contributed important aid to the distribution of well-divided instruments for the ordinary purposes of navigation and surveying. The Astronomer Royal, when engaged in the construction of the Greenwich Transit-Circle, after anxiously examining the various methods of graduating the Zenith-Distance-Circle, satisfied himself that it would be done most accurately by the use of Mr. Simms' dividing-machine; and the excellence of the result has proved the correctness of the decision.

Mr. Simms's character was remarkably one of fairness and candour. Persons who transacted much business with him, though they began with him in his character of tradesman, usually learnt to recognise him as a friend.

Mr. Simms was an active member of our Council at several different periods. His services were given in his own quiet and unpretending manner. His voice was little heard, but his colleagues knew that his sound judgment and hearty co-operation could be relied on.

The observations at the Royal Observatory, Greenwich, maintain that steadiness of character which has given to its publications so great a value. In the last summer the great Equatoreal was made efficient, but the absence of the Astronomer Royal for observation of the eclipse and other interruptions have prevented it from being brought into regular use. It has, however, been employed to a considerable extent in the preparation of delineations of *Jupiter* and *Mars*. The former of these planets has exhibited, in the last year, some appearances never before recorded; and it has appeared very desirable to register, as soon as possible, anything which seems to indicate a change in the constitution of that great body.

The time-communications of the Royal Observatory (of which the population of the British Isles is every day availing itself to an extent of which it is little aware) are now made by galvanic signals conveyed by open-air wires.

The Astronomer Royal retains the intention, as soon as the state of reductions shall permit, of preparing a 7-years' Catalogue of Stars from the observations made at the Royal Observatory from 1854 to 1860.

The printing of the *Greenwich Observations* for 1859 is finished in all important points. Some additions are contemplated, which will prevent its distribution for a short time.

Mr. Main has been succeeded, as First Assistant, by Mr. Edward James Stone, Fellow of Queen's College, Cambridge.

From the Royal Observatory, Edinburgh, we have a printed Report addressed to the Board of Visitors there, on the 24th of April, 1860; and have further accounts to the end of January 1861.

The printing of the past observations with transit instrument and mural circle has been in continuance, and has reached the end of 1858. The instruments themselves have had some subsidiary applications made to them, to promote the facility and precision of handling and using them for ordinary observations; and some of an extra character have been applied to the shutter openings of the transit instrument, as well as to the telescope itself, to fit it for a special series of measures, adapted to inquire into the supposed "Solar Refraction" of Prof. W. Thomson. This series commenced on the 1st of May, and for two or three days went on somewhat hopefully; but immediately thereafter began a cloudy season, which continued without any interruption during nearly the entire summer, and especially during the period of the larger stars in *Taurus* and *Leo* being near the Sun's place. Attention had been called in the printed report to the unequalled opportunity which the then approaching solar eclipse would give, to those who should be within the range of its totality, for observing stars situated favourably and effectively to develope the solar-refraction effect to a definite and tangible amount, should it really exist to the degree and in the manner anticipated. It is believed, however, that amongst the numerous and more certain phenomena which occupied the attention of the many able astronomers who witnessed the eclipse in Spain, the solar-refraction question did not form one of them; and hence it is left to future times to make, during the dark interval of another total eclipse, an observation pregnant (it may be) with important result on the physics of the Sun and the Solar System, simple and straightforward in itself, but which has never been made yet from the commencement of the world; viz., the measure of the distance of two stars, not more than two or three degrees apart, when the Sun is apparently between them. Although the Edinburgh Observer was unable to visit Spain, he had communicated with some who were more fortunate, and has since been assured that there is every reason to believe that a 6-inch object-glass would have been able to show stars of the 5th or 6th magnitude, at not further than half to three-fourths of a degree from the border of the Moon's disk when completely eclipsing the Sun.

The occultations of the *Pleiades* in September were duly observed at Edinburgh, in concert with the Americans; and by means of an electrical apparatus, which so intensified the seconds'-beats of the transit clock, as to enable them to be heard equally by the transit observer, and by the watcher of the occultations, in opposite parts of the building.

The electrical time-ball, daily worked by the Observatory, has given rise amongst the citizens of Edinburgh to a desire to have its visible manifestations supplemented by an audible signal, in the shape of a cannon in the Edinburgh Castle, to be fired by electrical signal from the Observatory. This desire

has not only manifested itself at the meetings of public commercial companies, but also in the collection of so large a subscription to pay for the expenses of the connecting wire, and the gunpowder, that Her Majesty's Government have been pleased to entertain the proposal to some extent, and experiments were lately made by the military in the Castle, as to the best size of gun, charge of powder, and general position.

The Edinburgh Observatory still carries on the reduction of meteorological observations from 55 stations in Scotland, for the Registrar-General's Department; and in the course of a special inquiry undertaken with regard to the circumstances and characteristics of a remarkable and destructive storm on October 3d, 1860, it has had the honour of receiving special communications of hourly or other frequent observations from the several establishments of Greenwich, Oxford, Glasgow, and Armagh; from the Imperial Observatory of Paris, with returns from several French stations; and similarly, from the Royal Observatory of Brussels, from the same of Christiana, Konigsberg, and Utrecht, from the Imperial Physical Observatory of St. Petersburg, and from Altona, Copenhagen, and Iceland.

The ultimate reputation of an Astronomer in a public Observatory rests in part upon his successor, upon whom depends the manner in which his growing crops are brought to maturity. The appointment of the Rev. R. Main, in June last, to the Radcliffe Observatory at Oxford will secure to our lamented late colleague, Mr. Johnson, the full credit due to his acknowledged skill and industry. This appointment has given high satisfaction to the astronomical world; the subject of it being their own President, the Council will say no more. During the interval between the death of Mr. Johnson, in March 1859, and this appointment, the Observatory was in charge of Mr. Quirling, the First Assistant, and meridian observations of stars were made with the transit instrument and the meridian circle to as great an extent as his own unassisted strength permitted. The meteorological observations were carried on without interruption during this period by Mr. Green. The printing of the Radcliffe Catalogue of Stars was also completed. This important work is noticed in another part of the present Report.

On Mr. Main's assuming the direction of the Observatory his first care was to provide for the publication of the Radcliffe Catalogue, and the examination and revision which were necessary occupied him for some time. The next point of importance was to put the Heliometer into a state fit for observing. Its general condition was very satisfactory, but the telescope was found to work so stiffly in its collars that it would have been impracticable to use it with effect for measuring angular distances, and, there being no provision for illumination of the field, it could not be used as an ordinary

equatoreal instrument. This defect of stiffness having been remedied, the telescope-tube was also perforated near the eye-end, and a ring-reflector was inserted for throwing light down the telescope by means of a small lamp, and by this means good illumination is obtained. The only circumstance to be regretted is that, by the taking out of the object-glass, some small disturbance has taken place in the relative position of the halves, so that at the zero, when the images ought to cover each other they are again separated by a small interval. This defect will be removed on the first opportunity, and the instrument will be then in a thoroughly satisfactory state.

The meridian instruments are employed chiefly for the completion of the observation of Mr. Johnson's "Catalogue of Remarkable Objects," and Mr. Main proposes to commence shortly the compilation of another Star Catalogue, which shall include the places of all the stars which have been observed from the year 1854 to 1861, both inclusive. He proposes also to employ the heliometer for the observations of the larger planets, and for observation of a catalogue of Double Stars.

While thus passing in retrospect the now concluded labours of the late Mr. Johnson, the Council take this opportunity of making some remarks which they think worthy the notice of those who are members of the governing bodies of our public Astronomical Institutions. They are aware that questions of policy in regard to expenditure arise from time to time, and are decided on their apparent merits at the time, and that trustees may often wisely hesitate to follow every recommendation to supply new and expensive instruments. In a manufactory, a Principal, while certainly not adopting all the promising schemes which patentees are too ready to put before him, will take care as early as his means permit, to introduce any new and improved machinery whereby better and increased production may be profitably secured. In an Observatory where profit is not the motive, but economy and improvement should be, it is equally bad policy to retain old instruments too long, when the introduction of new ones would enable the Astronomer and his staff to do in one year the work of three with the old. It is to be remembered also, that when by defect of instrumental arrangement or deficiency of computing power, a limited work is thrown over a needlessly long term of years, the risk of the Astronomer's labours being left incomplete by his death, and perhaps never made available at all, is also greatly increased. Mr. Johnson's life was fortunately continued sufficiently for his work to have escaped all but the final risk of injudicious publication, and this has been avoided by the care and interest of our President. Another instance has lately occurred in which our science has had better fortune than was apparently insured by the arrangements of foresight. The recently published Armagh Catalogue is the

summary of so protracted a series of observations that the happy result can only be regarded with the feeling of those who have escaped shipwreck. With good organisation and a good transit circle, such as Groombridge had, the work of revising the Catalogue of Groombridge might certainly (judging by the Redhill Catalogue of Mr. Carrington) have been performed within five years; and if this view be correct, it is clear that the possession of such an instrument would have left years of Mr. Johnson's life free for the attainment of still further results. It is part of the self-constituted duty of a deliberative body, such as the Council of this Society, to point out with respect, but still with candour and completeness, any course which sound policy may recommend for the prosecution of astronomy. The Astronomer Royal once calculated the cost to the country of one complete observation of the Moon in both elements, including rental of premises or the equivalent, wear and tear of instruments on a series of years, share of salaries, printing and incidental expenses, and we believe he made it about 10*l.* We do not often dwell on the cost of our productions, but it is desirable that the costliness in mere money should not be lost sight of, whether the country supply the funds or there be an endowment of private origin concerned. We should much like to see a competent examination, with the cost per thousand of concluded positions of stars (with due regard to the degree of accuracy attained) for different establishments, and have little doubt that at the head of the list of economical production would stand Bessel's Zone-observations. The admirable work now in hand by Dr. Argelander, though designedly of another order of execution, calls for notice in this respect, but would lead our intended remarks beyond the object in view.

The ordinary work of the Cambridge Observatory is described in the usual Report of the Observatory Syndicate. Shortly after the date of the Report (May, 1860) Mr. Challis succeeded in engaging a second computer, who, as well as the first, is paid from the proceeds of the Sheepshanks Fund. With the aid of his two assistants and the two computers, he made great progress in the latter half of last year in the reduction of the meridian observations of past years, which was advanced completely to the end of 1857. The meridian observations of the three last years, which were comparatively few, are now occupying attention. The observations of late have been of a miscellaneous character, and the number of the regular meridional and equatoreal observations has been much diminished. Since May of last year, meridian observations have been resumed solely for the purpose of determining the places of comparison stars. Some good micrometer measures of the solar eclipse of July 18 were obtained, and the scrutiny of the Sun's disk for detecting intramercu-

rial planets has been continued, but without success. Last summer, as during several previous years, the corrections required for the effect of the forms of the transit pivots on the times of meridian passage were ascertained. The conclusion arrived at is, that unless this source of error be continually guarded against, determinations of differences of longitude cannot be depended upon.

Professor Challis completed, in the summer, a second series of measures with collimators moveable about the Mural Circle, for the purpose of ascertaining the effect of flexure on the circle readings; and the result obtained was, that six microscopes almost entirely eliminate errors of reading due to flexure of the material, care being taken to have a uniform temperature in all parts of the circle room. The discordance of zenith points exhibited in direct and reflected observations with the large Circle is to an amount which flexure of the material will not account for.

The Sheepshanks Fund has hitherto only been devoted to paying computers, and that to a moderate amount, so that the proceeds are accumulating. What Professor Challis has recommended is, to employ the reserve fund, when of sufficient amount, in purchasing a new Transit-Circle, which this Observatory stands much in need of; neither the transit nor the mural circle being now as good and efficient as the present state of astronomical science requires.

Professor Challis has laid before the Council of the Senate a formal request to be relieved from the duties of the Observatory, retaining the Professorship. A syndicate has been appointed to consider the matter, and report in the course of this term. His reason for making the request is, that he has been actively engaged as a practical astronomer for twenty-five years, and thinks he will do well to retire from this kind of duty before he is unable to discharge it, and while he is capable of astronomical and scientific work demanding less bodily exertion, and in great measure arising out of the practical work which he has done at this Observatory. Under these circumstances, it is to be hoped that Professor Challis will remain in fact, though not in name, closely connected with the Observatory which he has so long and so ably conducted.

Vol. xix. of the *Cambridge Observations*, containing the meridian observations of 1852, 1853, and 1854, is not yet published, a few sheets of the Introduction remaining to be printed. The delay has been caused by its being necessary to insert a great deal of fresh matter into the Introduction, in order to describe fully new apparatus and new modes of observing adopted in the course of those years.

Professor Grant obtained definitive control of the Glasgow Observatory in the month of May last year. The principal

instrument of the establishment is a meridian circle of $3\frac{1}{2}$ feet diameter, by Ertel of Munich, with which a course of observations has been commenced. A portion of the results, consisting of observations of the Minor Planets, has been recently forwarded to Professor Peters for insertion in the *Astronomische Nachrichten*. Meteorological observations continue to be made nearly on the plan hitherto pursued. Steps have been taken for establishing an electric communication between the Observatory and the central parts of the city, with the view of transmitting correct Greenwich time from the Observatory, by the method which Mr. Hartnup has practised so successfully at Liverpool.

At the Liverpool Observatory Mr. Hartnup has been engaged in alterations, now nearly completed, which have been progressing during the past nine months. A new chronometer-room, library and computing-room, have been added to the establishment. In the former, every possible care has been taken to render it as perfect as practicable for testing and ascertaining the rates of chronometers in different temperatures. This room, which is eighteen feet by twenty-eight, has a large double skylight, and the walls, which are very thick, have a cavity between them. The room can be warmed by hot-water pipes, which are carried under the floor, but this will not often be required, as there are in the room two warm-air chambers which will hold upwards of one hundred chronometers each. The tops of these warm-air chambers are made of plate-glass, so that the chronometers standing in their boxes, with the lids open, may be compared as frequently as desirable, and their rates in different temperatures ascertained without moving them from one place to another. The heating is all by gas, the pressure of which is regulated by a governor. The arrangements are so perfect that Mr. Hartnup hopes soon to see the rates of the chronometers, deposited at the Observatory by makers for the purpose of showing the perfection of their performance, published at regular intervals. The rates in different temperatures supplied to mariners will also be much more perfect than it was possible to obtain with the old arrangements.

The performance of the large clock at the Victoria Tower, which is controlled by Mr. Jones' method, has been very satisfactory. The striking of this large clock is quite simultaneous with that of the Liverpool Town Hall, which is also controlled in the same way, and at 1 P.M. they may be seen to be coincident with the dropping of the time-balls. The dropping of the Victoria Tower time-ball, by a mechanical arrangement with the distant clock, which is controlled by the Observatory normal clock, has been found to answer perfectly, no error having arisen from want of battery power or from any irregularity in the passage of the galvanic current.

The general routine duties of the Observatory have been carried on much in the same way as in former years, but the extensive alterations above named have prevented Mr. Hartnup from doing much with the Equatoreal.

The great activity of the Sun in producing spots during the year 1860 has restricted the attention of Mr. Carrington and his assistant almost entirely to their observation and treatment. The past year has been one of maximum action; and it may give some notion of the constant pressure of the subject on the observer, when it is stated that, of the stock of about 5000 accurately reduced positions, accumulated by Mr. Carrington since the beginning of the year 1854; 1893, or nearly two-fifths, are the produce of the past year. Much of this is attributable to the interest and assiduity of Mr. von Bose, by whom the greater part of the actual labour was performed. Mr. Carrington greatly regrets that at the close of the year Mr. von Bose was obliged to leave him, in order to resume the profession of chemistry, for which he retained a preference; and he cannot expect easily to meet with another assistant equally valuable to him.

It may appear to some that in thus largely observing in this field, an unreasoning instinct for the accumulation of any sort of observations is exhibited; but Mr. Carrington is deliberately following out a plan laid down at the commencement, of subjecting this phenomenon to severe record throughout one complete period, and it will be the fault of circumstances beyond his control, if this record should be interrupted before the next minimum is past. A sound basis of thorough observation has never before been laid in this department of astronomy, from which replies might be obtained to many hypothetical questions as well as to others suggested by the indications of the observations themselves. Reductions to place on the Sun have kept pace with the record, the whole of the observations of the past year being already worked out. Further discussion of these places will be pursued as his leisure permits.

Mr. Carrington called the attention of the Society in the month of May last to a first draft of the periodic variations of frequency for the past 120 years, concluded from the researches of Prof. Wolf into old documents mostly in MSS., and he would now again call attention to the last communication of his indefatigable co-labourer, wherein he has given his concluded relative numbers for this period of years, expressed in the same unit. The curve formed by laying down these numbers offers as interesting a problem for solution as any that has been laid before astronomical inquirers.

Mr. Lassell informs the Council that the two lithographs sent to the Society are almost the only fruits of the 4-foot Equa-

toreal. The anomalous weather, remarked by everybody, has made the instrument hitherto comparatively useless. He has been occupied in grinding and polishing a second, or reserve speculum, B, which is now in the tube, and is, he believes, fully equal in form of curvature to A, perhaps superior to it; for a little falling off of perfection towards the edge in A he does not detect in B.

But he has waited hitherto in vain for such a quality of sky as would enable him to determine the real amount of superiority of efficiency of this telescope over the 2-foot Equatoreal, whether it approaches its theoretical ratio of two to one.

At the Hartwell Observatory, since the 1st of January, 1859, till his sudden appointment, last October, to the Madras Observatory, on the recommendation of the Astronomer Royal, Mr. Pogson has been assiduously carrying on his researches on variable stars, and taking advantage of every opportunity for completing the sidereal charts connecting those of Berlin and Regent's Park. The Variable-Star Atlas is to be completed at Madras, with the express permission of Government.

Mr. De La Rue states that in his own Observatory at Cranford he has, during the past year, pursued photographic observations as continuously as the very unfavourable weather would permit.

Considerable improvements have been made in the driving machinery of his telescope, which leave but little to desire; and, as a necessary consequence, very fine lunar photographs have been procured. During the year whole constellations have been photographed by him: as two extremes, may be cited the *Pleiades* on the one hand, and *Orion* on the other. Since his return from Spain he has engaged Mr. Reynolds, one of his assistants during the eclipse, with the object of prosecuting celestial photography without interruption, should the weather, which has hitherto been very unpropitious, permit.

Among the works for the present and future years may be mentioned the following: the photography of the Sun's spots on a scale sufficiently large to admit of the study of the changes which they undergo from time to time; in view of which it is proposed to make these photographs on the scale of five feet to seven feet for the Sun's diameter; the exact determination of the libration, and of the diameters, polar and equatorial, of our satellite.

The work of the Kew photoheliograph has been considerably interfered with by the preparations for the trip to Spain, which necessitated various additions to the instrument; and since the return of the expedition Mr. Beckley's other avocations, together with the badness of the season, have prevented its employment on as many occasions as could be desired.

In consequence of the press of meteorological work now performed at Kew, the committee find it difficult to make adequate arrangements for the systematic continuance of the work of the photoheliograph, and it has been proposed to Mr. De La Rue to take charge of the working of the instrument at his own Observatory.

It is almost unnecessary to recall the attention of the Society to the phenomena and observations of the important total Eclipse of the Sun of 1860, July 18. Never before has the totality of an eclipse been observed by so many persons, nor probably ever through such an extent of country. In the year 1842 we believe that only two persons (the late Francis Baily and the present Astronomer Royal) made journeys out of England expressly for the purpose of seeing the total eclipse. In 1860 about forty observers went from England to Spain for that observation. From Scandinavia to Italy, astronomers, official and private, converged to the northern provinces of Spain; the French Government equipped an admirable and well-arranged expedition to Spain, at the same time providing for observations in Algeria; and the services of the British Government, in the appropriation to the use of astronomers, of the magnificent steam-ship the Himalaya, and in the making every conceivable provision for their wants and their comforts, will not be soon forgotten. The United States of America did not omit to establish temporary observatories at some of the most important points on the new continent; and finally (though first in absolute time) the totality was perfectly observed and carefully depicted by a British officer in the neighbourhood of Vancouver's Island, where the elevation of the Sun above the horizon was less than three degrees. Most of the foreign observers, and some of the English, have published their accounts, in different degrees of detail. But it has been found impossible hitherto to sufficiently examine, with a view to digest, the vast mass of accounts, principally from the Himalaya Expedition, which have come into the hands of the Astronomer Royal.

The part which photography has played in some of these observations will be presently referred to.

At places beyond the band of total obscurity the eclipse has been carefully observed. At our National Observatory, an extensive series of transit-observations and micrometer-observations was arranged, with the view of furnishing materials for ascertaining the errors, at that time, of all the tabular elements involved in the computation of the eclipse.

During the past year photography has proved itself of great value in exact astronomy. The solar eclipse of July 1860 afforded an excellent opportunity for testing the value of this method of recording phenomena, the duration of which is

so short as to defy all attempts of the most able observers to register them with precision by optical means, however much a preconcerted division of labour may reduce the amount of work to be done by each individual observer. Of the various problems remaining to be solved by observations of the total eclipse of the Sun in July last, the most interesting, perhaps, was the determination of the precise nature of the so-called red prominences, which were first seen in the solar eclipse of the year 1842. Fortunately, two photographic records, at two stations nearly 240 English miles apart and with instruments of a different character, have so confirmed each other as to place beyond all doubt the real existence of these phenomena. Mr. Warren De La Rue, operating with the Kew photoheliograph at Rivabellosa, near Miranda del Ebro (about lat. 42° 42′·5 N., long. 11^m 42^s W. 17 miles, towards the *north*, from the central line), and M. Aguilar, associated with Father Secchi, employing the Cauchoix telescope belonging to the Observatory of the Collegio Romano, at Desierto de las Palmas (about lat. 40° 4′·4 N., long. 0^m $1^s·6$ W. $4\frac{1}{2}$ miles, towards the *south*, from the central line), have obtained photographic representations of the different phases of the eclipse, including the totality.

These records of the appearances during the totality are quite concordant *inter se*, and one with the other, and show, incontestably, that the Moon gradually covered and uncovered luminous prominences which retained a fixed position with respect to the Sun. It thus appears impossible to doubt but that they are real appendages of the Sun; without, however, denying that their appearance may be altered by refraction at the Moon's surface. The popular results of these photographic observations have already been made public through the newspapers and scientific journals, but the subsequent discussion of the facts recorded has served to render still more manifest the great value of these photographic results.

Mr. De La Rue's photographs during the totality were two in number, but these two afford four epochs for the determination of exact numerical data. M. Aguilar's photographs of the totality, which measure 9-10ths inch in diameter, were four in number, but are wanting in that precision of details apparent in those of the former gentleman, which measure four inches in diameter. Mr. De La Rue procured by his well-arranged plans 31 photographs of the other phases of the eclipse, and has given to the Society, at two of its meetings, a *vivâ voce* statement of the measurements of the photographs, and of the results they establish. These results may be thus briefly stated: — The photographs having been advantageously enlarged, for purposes of observation, to 9 inches and 13 inches in diameter, measurements of the lunar and solar diameters give data, in regard to the ratios which they bear to each other, almost absolutely in accordance with theory; moreover,

with respect to the Sun, his equatoreal diameter is found to be measurably greater than his polar diameter. Measurements of the chord and of the versed sines of the cusps of the Sun and Moon give accordant results in regard to the angles of position of the line of centres of the Sun and Moon, and of their respective diameters; and, consequently, the distance of the Sun and Moon centres at the epoch of each photograph. With these data, the direction of motion of the Moon's centre, and the nearest approach of the lunar and solar centres, are determinable with great accuracy. Having found the relative positions of the centres of the Sun and Moon, Mr. De La Rue has etched upon an enlarged photograph on glass of the Sun, 9 inches in diameter, the luminous prominences seen on the first and second of the totality photographs, and has thus referred them to the Sun's centre, with great precision. Copies of the first photograph of the totality, superposed on the second, coincide absolutely in respect of those prominences visible in common at both epochs, and on both the first and second photographs can be traced the extent and direction of the Moon's motion.

The movement of the Moon apparent on each individual photograph, and the extent of movement evidenced by a comparison of the two photographs, are in strict unison with the demands of theory. One unexpected result of the use of photography in this case was, that it rendered evident the presence of certain prominences which, on account of their being not more luminous than the surrounding corona, did not impress the eye, but which, from the fact of their being of different actinic power, were nevertheless detected by the sensitive plate. Another remarkable and unlooked-for fact in connexion with these observations was, the great brilliancy, optically and actinically, of the luminous prominences and corona. The Kew photoheliograph, in which the focal image is magnified eight times, and its intensity consequently diminished fully 64 times, gave an impression of the luminous prominences in 20 seconds, and of the corona in one minute; whereas it did not give the slightest trace of the image of the Moon at full in one minute; and in the Cauchoix telescope the unmagnified focal image of the corona was well imprinted in 20 seconds.

The Council have to notice an error in the Annual Report for 1859, February 11. In the account of discoveries of small planets, *Calypso* (53) is attributed to M. Goldschmidt. As noticed, p. 166 of vol. xviii., it was, in fact, discovered by Dr. Luther, at Bilk.

During the twelve months which have elapsed since our last anniversary, five new bodies have been added to the group of Minor Planets revolving between *Mars* and *Jupiter*. The first (*Concordia*) was discovered on the 24th of March at Bilk

by M. Luther. The second (unnamed) was discovered on the 12th of September, at Paris, by M. Chacornac. The third (*Danaë*) was discovered on the 9th of September, at Paris, by M. Goldschmidt. The fourth (*Titania*) was discovered on the 14th of September at Washington, by Mr. Ferguson. The fifth (*Erato*) was discovered on the 14th of September, at Berlin, by Dr. Förster and M. Lesser, who determined its position under the impression of its being identical with the planet discovered on the 10th of the same month by M. Chacornac. Its existence as a distinct planet was established in the course of the following month. The total number of bodies constituting the group of Minor Planets now amounts to sixty-two.*

The list of Comets has been enriched by the discovery of four new bodies of this class in the course of the past year. The first was discovered on the 26th of February, at Olinda, in Brazil, by M. Liais, who saw it only on three subsequent nights, the presence of moonlight having prevented further observations of it. From its extreme southern position it was invisible in Europe. The observed places have been satisfactorily represented by a parabolic orbit. This comet exhibited the interesting phenomenon of two distinct heads.

The second comet was discovered on the 17th of April, at Hamburgh, by Mr. George Rümker. It was a faint telescopic object, and continued visible only during a short time. The elements of the orbit have been found to be sensibly parabolic.

The third comet was first seen on the 20th of June, at Utrecht, by M. Gronemann, and on the same day by Prof. Caswell, on the deck of the steamship Arabia, while on his voyage to England. When it attained its greatest brilliancy it was visible to the naked eye, and formed a conspicuous object in southern latitudes, where it continued to be observed till towards the end of August. M. Liais has found that the observations would be best represented by an elliptic orbit, with a period of about 1089 years.

The fourth comet was discovered on the 23d of October, at Marseilles, by M. Tempel. The observations of it consist solely of two places determined by the discoverer, and one by M. Villarceau at Paris, moonlight having soon rendered it invisible. From these observations a parabolic orbit has been calculated by M. Valz, who remarks that the elements bear some resemblance to those of a comet discovered by Pons in 1822.

The Council are happy in being able to announce, in their

* Since the date of the Meeting a sixty-third Minor Planet has been discovered by M. de Gasparis: see the conclusion of the present Number. —Ed.

Annual Report, the publication of the Radcliffe Catalogue of Circumpolar Stars. The delay in the appearance of this great work, the result of Mr. Johnson's star-observing for fourteen years, was caused solely by the temporary interregnum at the Observatory after his death, as the printing of it (with the exception of the Introduction) was completed in the summer of 1859. Copies were, however, most liberally distributed by the authority of the Trustees on its publication in December last, to the various institutions and individuals in every part of the world, who have an interest in astronomy, and there is no doubt that it will not disappoint the expectations of astronomers. It gives the accurate places of 6317 stars; most of them circumpolar in this latitude, the greater part of which are determined by not fewer than three observations in each element, while those stars included in Groombridge's catalogue of circumpolars, have been observed at least five times. The bringing up of Groombridge's places to the epoch of the Radcliffe Catalogue, and the comparison of the results, though it added considerably to the labour of the computation, forms a most useful part of the work, because, by this means, the proper motions of all these stars, amounting to 4243, have been virtually determined, and a basis is laid on a large scale for speculations in such branches of sidereal astronomy as depend on the proper motions of the stars. Amongst the subjects for congratulation in the active progress of various branches of Astronomy during the past year, the publication of this valuable catalogue must be reckoned among the greatest.

Among the astronomical works which have appeared during the last year, probably the greatest and most important is the *Theory of the Moon's Motion*, by M. Delaunay. Of this great work, which has been eagerly expected by astronomers, the first volume was presented to the Academy of Sciences by M. Delaunay at the meeting of December 24 last, and it forms the twenty-eighth volume of the Memoirs of the Academy. By the various discussions which have recently taken place concerning the lunar theory, and particularly by the controversies of its most distinguished investigators, the members of this Society have been made acquainted both with the magnitude and the enormous labour of the work in question, and also with the peculiarities of the method employed by its author, as far as he himself had given explanations in his various papers which appeared from time to time in the *Comptes Rendus* of the Academy. But the published work gives information on both these points which could not have been anticipated. With regard, for instance, to the labour expended upon it, it is sufficient to say that the development of the disturbing function was effected by means of 57 operations, and that the number of periodical terms in it is 461, occupying 138 pages of the printed work. In his preface M. Delaunay gives a very clear

account of the various processes which have been employed in effecting the developments in the lunar theory since the time of La Place, and of his means for pursuing his coefficients to the end of the work in their literal form, this being one of the chief points of difference of opinion between himself and M. Hansen. The peculiarities of his process are best given in his own words:—"In conformity with the excellent Memoir of Poisson of 1833," he says, "I have taken for my point of departure the differential equations furnished by the theory of the variation of arbitrary constants, and I have adopted a system of elliptic elements such that these equations may have the most simple form of which they are susceptible. The perturbing function, of which the partial derivatives, relative to the elliptic elements, furnish precisely the value of the derivatives of these same elements with respect to the time, may be easily developed in a series of periodical terms. If we did not take care, the introduction of this periodical series into the differential equations would be attended by a serious inconvenience: the time would result from terms involving sines and cosines, which would be a considerable check upon the employment of these differential equations for the determination of the lunar inequalities. I get rid of this inconvenience by a very simple method, which differs essentially from those employed before me for the attainment of the same end, and which has the great advantage of leaving to the differential equations the form which they had at first. As to the perturbing function, it is found by this means modified in such a way that the time no longer enters into it implicitly, excepting as it is introduced by the values of the co-ordinates of the disturbing bodies, and, in addition, a certain non-periodical term independent of the perturbing actions of these bodies. This being done, I suppress from the perturbing function the totality of the periodical terms which it contains, with the exception of one only, which I choose amongst those which have most influence in producing inequalities. In introducing this function, thus simplified, into the different equations, I find that they are completely integrable. I then profit by this integration to deduce from it formulæ, the office of which is to replace the six variables which I had by six others of the same kind. When, by the use of these formulæ of transfer-matter, the new variables are substituted for the old ones in the perturbing function and in the expressions of the co-ordinates of the moon, it results, first, that one of the important terms of the perturbing function disappears (the periodical terms which at first had been alone retained); secondly, that different inequalities corresponding to this term are introduced into the values of the three co-ordinates of the Moon; and further, that the values of the six new variables in functions of the term are determined by differential equations of precisely the same form as those which determined the values of the six variables for

which they have been substituted. Thenceforward, the integration of the differential equation being brought to the same point as in the preceding case, excepting the disappearance of a periodical term in the perturbing function, a new operation analogous to that which has just been effected causes in the same way another term of this function to disappear ; a third term may in the same way be taken away from it by means of a third analogous operation, and so on. In this manner, after there have been effected a sufficient number of operations of this kind, the perturbing function is found to be rid of its most important terms, and the problem is thus rendered simple enough to be treated in the same manner as if it were a question of the perturbations of a planet or of the Sun."

The author, after giving a summary of the published volume, states that the second volume will contain, 1st, the different formulæ the office of which is to take account of the terms which remain in the perturbing function after the fifty-seven preceding operations have been effected ; 2dly, the expressions of the three co-ordinates of the moon, with *all* their inequalities to the seventh order inclusively for the longitude and latitude, and to the fifth order for the reciprocal of the radius-vector ; 3dly, various chapters intended to complete these expressions of the co-ordinates of the Moon, by taking account of everything which had provisionally been put on one side for the purpose of having to consider only the capital portion of the problem.

Such is a brief account of perhaps one of the most laborious analytical works ever accomplished by a single individual unaided. For fourteen years the author has been working without the assistance of a single computer, and uncheered by anything but his own clear views of his theory, and his consequent conviction that the result, when accomplished, would be worthy of the pains bestowed upon it. We may congratulate not only this Society, but the civilised world, on having at length before it this imperishable monument of combined human industry and talent ; and at the same time offer also our congratulations to M. Delaunay that he has at length seen the end of his severe labour, and is now reaping the fruits of it in the intrinsic value of the work, and in the respectful admiration of contemporary astronomers.

During the past year has been published a new Catalogue of the Library of the Pulkowa Observatory, by M. Otto Struve. Though the titles are briefly given, they fully serve to identify ; and this publication is very valuable. Great pains must have been taken to form this collection. The difficulty of forming a tolerably complete collection of known works—that is, already described by bibliographers—can only be matched by the facility with which a collection may be made of works which bibliographers have *not* enrolled. Lalande, whose bibliography

has not been surpassed in extent, has in his list works of the 15th, 16th, and 17th centuries, to the number of 2193. Of these the Pulkowa library possesses 973 works, or one out of three. Nevertheless, this same library could add one out of three to Lalande's list; for it possesses 905 works of the three centuries in question, of which Lalande knew nothing. It says something for the biographical utility of our Society that there are five *foreign* astronomers of whom no biographical accounts have found their way to Pulkowa except those in our *Monthly Notices*.

It will be in the recollection of the Fellows of the Society that, after a notice by the Astronomer Royal of the fitness, in different parts of the earth, of the summers of 1860 and 1862 for observations of *Mars* with a view to determine his parallax, an ephemeris of *Mars* and a catalogue of comparison-stars, illustrated by an engraved chart, were circulated by the Society, for facilitating the required observations. The proposal, however, failed totally. The northern observers, both in Europe and in America, were all so much interested in the observation of the total Eclipse of the Sun as to be unable to undertake the observations of *Mars*, and, even if astronomical engagements had permitted it, the bad weather and the southern declination of *Mars* would have greatly diminished the opportunities of observation. At the Observatory of Madras, the Observer (Major Tennant) judged the mounting of his Equatoreal (in the German form) to be too unstable to give trustworthy results; and at the Cape of Good Hope, the Observer, we believe, was distracted with other occupations. The Society will doubtless be anxious that every effort should be made to apply this method effectually at the ensuing opposition of *Mars* in 1862.

The Astronomer Royal, in his remarks upon the means at our disposal during the next few years for determining the amount of solar parallax, adverted to the importance of new tables of the planet *Venus*. Our illustrious associate, M. Le Verrier, has recently supplied this desideratum in so complete a manner as to leave little or nothing to be desired. His theory of the planet, which is almost wholly founded on the observations taken at the Royal Observatory, Greenwich, since the time of Bradley, with the Tables themselves, will form a part of vol. vi. of the *Annales de l'Observatoire Impérial de Paris*; but an outline of the principal results of M. Le Verrier's theoretical investigation appeared in the *Comptes Rendus* for 1860, Nov. 26. Its most remarkable feature is the confirmation it gives to a former inference of M. Le Verrier's, when discussing the lunar equation in the Earth's longitude, viz., that the received value of the Earth's mass is too small by a *tenth* part, and therefore the solar parallax as determined (under

doubtful circumstances) from the transits of *Venus* in the eighteenth century, will require a notable augmentation. On this subject the author observes that in consideration of its serious importance and delicacy, he contents himself at present with having added to the data previously in our possession for resolving the problem of the determination of the planetary masses, and before drawing a definite conclusion will await the completion of the theory of *Mars* upon which he is now engaged, and which will afford a third determination of the value of the Earth's mass. It must be admitted that M. Le Verrier's elaborate researches have added greatly to the interest always attaching to the question of the amount of solar parallax. M. Le Verrier having had the courtesy to forward copies of the tables of *Venus* to the Superintendent of the *Nautical Almanac* in anticipation of the time of their issue to the public, the ephemeris in the forthcoming volume for 1865 will be founded upon them.

Papers read before the Society from February 1860 *to February* 1861.

1860.

Mar. 9. On the Luminous Intensity of the Centre of the Sun. M. Chacornac.

Ephemeris of Variable Stars for 1860. Mr. Pogson.

On a Mode of getting rid of Personal Equation. Col. Shortrede.

Notes on Auroral Phenomena. Lieut. Chimmo.

On Phenomena connected with a Transit of *Jupiter's* third Satellite. Mr. Prince.

Star Occultations and Lunar Eclipse observed at Hartwell. Mr. Pogson.

On some previous Transits of Dark Bodies over the Sun. Mr. Carrington.

Proposed new Design for Vertically Placed Transit Circles. Mr. Carrington.

Note on an Eye-piece. Mr. Carrington.

Formulæ for the Reduction of Pastorf's Solar Observations. Mr. Carrington.

Extract of a Letter to Mr. Carrington. M. D'Abbadie.

On Future Observations of *Vulcan*. M. Radau.

On the Heat engendered by the Fall of a Meteor into the Sun. Mr. Waterston.

On the Variability of the Proper Motion of *Sirius*. Rev. R. Main.

Occultations of Stars by the Moon. Mr. Airy.

Mar. 9. Tables of the Developments of Functions in the Theory of Elliptic Motion. Mr. Cayley.
Occultations of Stars by the Moon. Mr. Burr.
Morning Illumination of the Lunar Crater *Hippalus*. Mr. Birt.
On the Total Solar Eclipse, July 18, 1860. Mr. Airy.

April 13. Observations of Small Planets. Mr. Airy.
Observations of *Hygeia* and *Urania*. M. Lepissier.
On an Appearance in *Jupiter*. Mr. Long.
On the Performance of Mr. Fletcher's new Equatoreal. Capt. Jacob.
On the Parallax of α *Herculis*. Capt. Jacob.
On the Appearance of *Jupiter's* third Satellite on its Disk. Capt. Noble.
Extract of a Letter to Mr. Carrington. Lieut. Gilliss.
Note on one of the Companions of σ *Orionis*. Rev. T. W. Webb.
Suggestions for a true Estimate and Register of the Colour of the Stars, &c. M. Drach.
On the Projection of *Saturn* on the Dark Limb of the Moon. Rev. B. Powell.
On the Appearance of *Jupiter's* Satellites while Transiting the Disk of the Planet. Rev. W. R. Dawes.
On the Figure of the Earth. Capt. Clarke.
Observations of Minor Planets. Mr. Pogson.
Reply to various Objections which have been brought against his Theory of the Secular Variation of the Moon's Mean Motion. Mr. Adams.
Solar Spots in High Latitudes. Mr. Carrington.
On the Secular Variation of the Moon's Motion. Rev. R. Main.
On the Appearance of *Jupiter*. Mr. Airy.
On the Satellite of *Saturn* "*Mimas*." Rev. W. R. Dawes.

May 11. Catalogue of Positions, &c. of 398 Double Stars. Lord Wrottesley.
On the Problem of the Rotation of a Solid Body. Mr. Cayley.
Note on Mr. Pollock's Communication, No. 29. Mr. Airy.
On the Lunar Acceleration. M. Delaunay.
Apparent R.A. of the Moon's Limb observed at Washington. Lieut. Maury.
Observations of Minor Planets. Mr. Airy.
Note on the Lunar Acceleration. M. Pontécoulant.
Observations of *Hyperion*. Mr. Lassell.
Note on some Variable Stars of unknown or uncertain Period. Mr. Pogson.

May 11. Observations of Minor Planets. Mr. Airy.
On the Value of the Constant of Aberration. Rev. R. Main.
Observations sur les Formules employées jusqu'à présent pour déterminer par la Théorie le Coefficient de l'Équation Séculaire du Moyen Mouvement de la Lune. M. de Pontécoulant.
On the supposed Variability of the closest Companion of σ *Orionis*. Rev. W. R. Dawes.
Morning Illumination of part of the *Mare Imbrium*. Mr. Birt.

June 8. Postscript to Reply to M. de Pontécoulant. Mr. Adams.
On Projection in Lunar Occultations. Rev. T. W. Webb.
Occultation of *Jupiter* by the Moon. Capt. Noble.
Observations of Donati's Comet. Sir T. Maclear.
Comparison of Burckhardt's and Hansen's Lunar Tables with Greenwich Observations from 1847 to 1858. Mr. Airy.
Notes of Errors in Mr. Baily's Tables and Formulæ. Mr. Farrell.
Occultation of *Jupiter* by the Moon. Mr. Gaunt.
On Ancient Assyrian Observations of *Venus*. Rev. Dr. Hinckes.
On the Importance of making Observations on Thermal Radiation during the coming Eclipse of the Sun. Prof. Thompson.
Occultation of *Jupiter* by the Moon. Mr. Airy.
Réponse aux Observations présentées par M. Adams sur différentes Objections élevées contre sa Théorie de l'Accélération du Moyen Mouvement de la Lune. M. de Pontécoulant.
Elemens de la Comète decouverte à Olinda le 26 Fevrier, 1860. M. Liais.
Occultation of *Jupiter* by the Moon. Mr. Burr.
On a Grey Stripe eastward of Lunar Crater *Geminus*. Mr. Birt.
Note on the History and present Condition of the Problem, "To find the Latitude by Observations of the Pole Star at any time." Mr. Riddle.

Nov. 9. Devéloppement de la Fonction Perturbatrice en Série. M. Kowalski.
Observations taken at Redhill on the 18th July, 1860. Mr. Carrington.
On the Lunar Theory. Sir John Lubbock.
Observations of a Comet made in Australia. Mr. Scott.
Observations of Comet III. 1860. Mr. Ellery.
Approximate Elements of Planet ㊿. Mr. Ellis.

Nov. 9. Observations of the Moon and Moon-culminating Stars at Victoria. Mr. Ellery.
Elements of Comet II. 1860. Mr. Seeling.
New Variable Star in *Ophiuchus*. Mr. Pogson.
Solar Eclipse, July 18, 1860. Mr. Morton.
Ditto ditto Capt. Noble.
Ditto ditto Mr. Burr.
Ditto ditto Mr. Chalmers.
Ditto dttto Mr. Prince.
Ditto ditto Mr. Stothard.
Ditto ditto Mr. Riddle.
Ditto ditto Rev. Geo. Fisher.
Ditto ditto Mr. Janson.
Ditto ditto Rev. W. R. Dawes.
Observations of a Comet. Mr. Stothard.
Ditto ditto Col. de Rottenburg.
Ditto ditto Mr. Clark.
Note accompanying Lithograph of Nebula. Mr. Lassell.
Observations of a Comet at Sea. Mr. Krabbe.
On the Duration of Twilight at Toulouse. Mr. Petit.
Sun-spot Observations connected with the late Solar Eclipse. Prof. Smyth.
Elements and Ephemeris of Planet (59). Mr. Ellis.
On the Magnitudes of the Asteroids. Mr. Pogson.
Changes in 808 *Messier*. Mr. Pogson.
Observations of Solar Eclipse, July 18, from Hudson's Bay. The Hudson's Bay Company.
On a Photograph of the Sun. Prof. Challis.
Solar Eclipse, July 18, 1860. Mr. Airy.

Dec. 14. On some Formulæ relating to the Variation of the Plane of a Planet's Orbit. Mr. Cayley.
Observations of Solar Spots, with Drawings. Rev. Mr. Howlett.
Solar Eclipse, July 18: Photographs taken in Spain. M. Aguilar.
Observations on Solar Spots and Temperature. Mr. Hockley.
On a Method of determining Longitude by means of Observations on the Moon's greatest Altitude. Mr. Spottiswoode.
On the Motion of the Solar System and Distribution of Perihelia of Comets in relation thereto. Mr. Carrington.

1861.

Jan. 11. Results of Meridional Observations of Small Planets. Mr. Airy.
Note sur les Inégalités Lunaires à longues Périodes dues à l'Action Perturbatrice de *Vénus*. M. Delaunay.
On three new Variable Stars. Mr. Baxendell.

Jan. 11. On the Revolutional Velocities and Distances of the Planets. Mr. Glennie.
Addition to Paper, No. 134, "On the Lunar Theory." Sir J. Lubbock.

List of Public Institutions and of Persons who have contributed to the Society's Library, &c. since the last Anniversary.

Her Majesty's Government.
The Lords Commissioners of the Admiralty.
The Secretary of State for India.
The Postmaster-General.
Committee of Council on Education.
Royal Society of London.
Royal Asiatic Society.
Royal Geographical Society.
Royal Society of Edinburgh.
Royal Dublin Society.
Royal Institution.
Geological Society.
Linnean Society.
Zoological Society.
Photographic Society.
Society of Arts.
British Association.
Art-Union of London.
Institute of Actuaries.
British Horological Institute.
The Radcliffe Trustees.
Literary and Philosophical Society, Manchester.
Literary and Philosophical Society, Liverpool.
United Service Institution.
Historic Society of Lancashire.
Royal Society of Tasmania.
The Public Library, Calcutta.
L'Académie Impériale des Sciences de l'Institut de France.
Le Dépôt Général de la Marine.
Le Bureau des Longitudes.
The Society at Cherbourg.
L'Académie des Sciences, Montpellier.
L'Académie des Sciences, Dijon.
Imperial Academy of Vienna.
Royal Academy at Berlin.
Royal Observatory at Munich.
The Society of Physics at Berlin.

Royal Academy of Sciences, Brussels.
Royal Observatory, Brussels.
The Society at Leipsig.
The University at Göttingen.
La Société de Physique, &c. Geneva.
The Academy of Sciences, Stockholm.
Royal Academy of Sciences, Amsterdam.
Society of Sciences, Batavia.
Royal Academy of Sciences, Copenhagen.
Imperial Academy, St. Petersburg.
Imperial Observatory, Poulkowa.
Observatory, Dorpat.
Observatory, San Fernando.
Royal Observatory, Madrid.
Musico Fisico, Florence.
The Institute, Bologna.
Royal Academy of Sciences at Turin.
Philosophical Institute of Victoria.
The Department of State, Washington.
American Philosophical Society.
American Academy of Arts and Sciences.
Smithsonian Institution.
Boston (U.S.) Library.
The Franklin Institute.
The Canadian Institution.
The Editor of the Athenæum.
The Editor of the Literary Gazette.
The Editor of the Critic.
The Editor of the Atalantis.
The Editor of the London Review.

M. Allé.
M. Aguilar.
Prof. A. D. Bache.
W. C. Bergen, Esq.
M. Béron.
M. Boquet.
J. C. Bloxam, Esq.
M. Biot.
Sir T. M. Brisbane.
Prof. A. Caswell.
E. H. Coleman, Esq.
C. O. Dayman, Esq.
M. Daussy.
Prof. De Morgan.
M. Döllen.
S. M. Drach, Esq.
Prof. Encke.
Col. Everest.
M. Fechner.
S. Fenwick, Esq.
Dr. Francis.
M. le Prof. Gautier.
Dr. B. A. Gould.
M. Gussew.
Prof. Hansen.
Sir J. Herschel.
J. Herapath, Esq.
M. D. Hill, Esq.
M. Hornstein.
Mrs. Hannah Jackson.
M. Laugier.
Dr. Lee.
Prof. Von Littrow.
Mr. Maillard.
Mr. E. Mailly.
Com. Maury, U.S.N.
M. Mettenius.
M. Moesta.

M. L'Abbé Moigno.
W. H. Morley, Esq.
S. Newcomb, Esq.
D. D. Owen, Esq.
Dr. Peters.
M. Plana.
Prof. Plantamour.
Wm. Pole, Esq.
M. Quetelet.
M. E. Roche.
J. D. Runkle, Esq.
T. H. Safford, Esq.
M. Santini.
Sig^a^. Scarpellini.
M. Schaub.
M. Schubert.
Prof. A. Secchi.
Capt. Shadwell, R.N.
Miss Sheepshanks.
Lt.-Col. Shortrede.
Prof. Silliman.
Admiral Smyth.
Prof. C. P. Smyth.
M. O. Von Struve.
J. Taylor, Esq.
C. Vignoles, Esq.
M. Wagner.
Dr. Weisse.
Mr. J. Williams.
M. Winnecke.
Dr. R. Wolf.
Jas. Yates, Esq.

Address delivered by the President, the Rev. Robert Main, on presenting the Gold Medal of the Society to M. Hermann Goldschmidt.

Gentlemen,—In the Report which has been read to you, you have been informed that the Gold Medal of the Society has been this year awarded by your Council to M. Hermann Goldschmidt, for his discoveries of thirteen small planets, and other astronomical works, and the duty devolves on me to explain to you the grounds of this award. This duty, though not necessarily an annual one, has become so in fact, on account of the activity with which the various branches of astronomy have been for many years cultivated, and the undeniable claims which some one or other of our members or associates has established by eminent services or contributions to the science. In fact, I find that since the year 1848 (memorable for our recognition of the eminent claims of no fewer than twelve astronomers, by the award of a Testimonial to each), there has not passed a single year in which the Gold Medal has not been awarded, and I am certain that few persons would be found at the present time who would venture to deny either the justice or the prudence of the award in each individual case.

And, on looking at the list of subjects, one is rather tempted to admire the profusion of talent and the amount of industry which are exhibited in the various works for which the Medal has been awarded, and at the mass of labour in every department of our science which has been thus brought under review before us, and, of necessity, analysed in our meeting-room. The memoirs which have been crowned by us relate in some

instances to the closet labours of the theoretical or the physical astronomer, and in others to the work of the practical observer. In one year we have to reward a brilliant discovery, the result of years of profound study and analytical investigations; in another, the patient labours of an amateur astronomer, who, at his own cost, has produced a copious and valuable catalogue of stars. Sometimes it is a literary work, as the *History of Physical Astronomy*, which has claimed the award; at others, the corrections of some of the most important astronomical elements by a skilful employment of high mathematical attainments on the results of observations.

But, amongst the claims based on discoveries, none have been more frequent of late years than those arising from the addition of new members of the solar system, especially in the remarkable group of planets which lie between the orbits of *Mars* and *Jupiter*. At the commencement of the year 1845, four only of these small bodies were known, and those had been discovered for nearly half a century without receiving any addition to their number: at the present time their number amounts to sixty-two.

In four instances already have the rewards of this Society been bestowed for discoveries of some of these small planets; and the claims are each year becoming greater, and to such an extent, as to demand an explanation why, when there have been and are still so many successful labourers in this field of research, we have selected one amongst them as particularly deserving of the Medal on the present occasion? To this it might be replied immediately, that M. Goldschmidt has laboured more successfully than his competitors, and that the addition of thirteen new members to the solar system is a fact so remarkable in itself and so honourable to him, as to place him beyond the reach of competition, and to give him so high a rank amongst the benefactors of science, as to make the bestowal of our Medal only a fitting mode of expression of our sense of his great merits.

And, indeed, this is strictly and literally true, and there is probably no single name amongst the astronomers who have distinguished themselves during the past twenty years which stands so high in the list of discoverers. But relative merit is, after all, not a ground for the award, and it will be necessary to go rather more deeply into the history of this branch of discovery before I can confidently appeal to your own judgments in corroboration of that of your Council in making this award.

Omitting the history of the first four of the small planets which were discovered at the beginning of this century, it will be necessary to recall to your recollection that the next discoverer was M. Hencke, of Driessen, who, in 1845, discovered *Astræa*, under circumstances as meritorious as are those which I shall have presently to point out to you in the discoveries

of M. Goldschmidt. To this discovery I attach very great weight, as regards the merit of the discoverer; and I would express my opinion that, by originating this branch of research in connexion with the Berlin maps, M. Hencke's claims are of a higher order than those of all who have successfully followed in his steps, and that, if your Council had not already recognised them by the bestowal of a reward, it would be, even at this distance of time, necessary to do so. It must, in fact, be remembered in connexion with those discoveries, that, after M. Hencke, there has been no novelty in the method of search employed. In the greater number of instances the Berlin maps have been employed; and the necessity of this mapping of the stars for facilitating future discoveries has reacted most advantageously on the progress of sidereal astronomy, and has been the chief cause of that accurate survey of the Northern heavens which is now all but perfect. As an honourable example of this kind of research, and of the clearness of view which led to it, I may mention Mr. Bishop's Ecliptic Charts, completed by Mr. Hind,—a work in itself most meritorious and useful, and rewarded at the time by several brilliant discoveries. Another great work of the same kind which must be mentioned is the series of Star-Catalogues of Mr. Cooper, in connexion with which we may mention the discovery of *Metis* by Mr. Graham.

Here, then, Gentlemen, we have at once a definite ground for the encouragement of this branch of discovery, in its intimate connexion with the advancement of sidereal astronomy; and I think we may venture to say, that any one who will undertake the labour of constructing a map of stars as low as the 10th magnitude, for a zone of the heavens of moderate extent not very far from the ecliptic, will, as a matter of course, be rewarded by planetary discoveries. The sweeping of the heavens for stars and the search for planets, if properly conducted, may form one and the same operation; and when we reward the results of such work, we may do so quite independently of any consideration of the value of the planetary discoveries in themselves, though, as I shall try to show, this consideration is also in itself of very great importance. On the other hand, the verification of existing maps, such as the Berlin charts, by frequent and laborious comparison with the heavens, even if the object be not the construction of a new map, is of itself highly important and meritorious, and has led to the rapid increase of discoveries in a branch of the science formerly but little studied, namely, that of variable stars. In these discoveries M. Goldschmidt has also taken a part. It is clear, therefore, that discoveries of small planets are so connected with the extension of other branches of astronomy, that they are in the highest degree deserving of encouragement; but it is equally clear that, in estimating the merit of such

work, our attention must not be fixed chiefly upon that which first attracts the applause of the uninstructed public — that is, upon the brilliancy of the discovery as such — but upon the amount of good and useful work well directed which it puts in evidence in connexion with sidereal astronomy.

Now, the work itself is of a nature to attract to it young astronomers of unbounded energy and zeal, as offering the best chance of success and distinction at an early period of life. The labour is severe, but the reward of perseverance is literally certain, and, as a consequence, a great number of competitors — thirteen, in fact — have won laurels in this field. This gives an average number of nearly five discoveries to each person; but, as usual, the rewards of labour have been very unequal, so that, while M. Goldschmidt has discovered thirteen planets, five of the aspirants have discovered only one each.

Next to M. Goldschmidt, the most successful have been Mr. Hind, M. R. Luther of Bilk, M. De Gasparis,* and M. Chacornac, who claim respectively ten, nine, seven, and six of the planets. Of others, Mr. Pogson has discovered three and Mr. Ferguson also three. M. Hencke discovered two, while Messrs. Graham, Laurent, Marth, Searle, and Forster, have each discovered one. The above statement, if we include the four more ancient small planets, accounts for the whole number, sixty-two, at present known.

The work, then, which M. Goldschmidt has accomplished is, in its cumulative aspect, a great work — greater, perhaps, than has yet fallen to the lot of any other observing astronomer. If we regard the discoveries individually, they are, as I have explained, not of that original or brilliant character which stamp some of the other great discoveries of this age; they are within the scope of most men of energy, who are gifted with sharp eyes, and capable of enduring the fatigue of long watching and examination of the heavens; but, conducted as they have been by M. Goldschmidt for eight years with scarcely any intermission, and resulting in the addition of so many new bodies to our known solar system, they are admirable, and rank their discoverer amongst the first observers of his age, and distinguish him as a man of whom France and Frenchmen may be proud.

Thus far, Gentlemen, I have abstained from saying anything of the means at the disposal of M. Goldschmidt for making these discoveries. I have allowed you to suppose, if you are not acquainted with his history, that he was at least upon a level in point of equipment with his rivals, some of whom (though not all) had the use of large telescopes in fixed observatories. Indeed, the apparent magnitudes of the planets

* The number discovered by M. De Gasparis is now eight.— Ed.

discovered would seem to make some such supposition necessary. For example, *Lutetia*, the planet first discovered by him in 1852, he estimated at the 9–10 magnitude; and I am sure it would not have occurred to any of us professional astronomers that such an object was likely to be looked for with success with any object-glass less than 4 or 5 inches. Well, Gentlemen, the telescope with which he made this discovery, by the help of the Berlin star-maps, was of 23 lines aperture, or rather more than 2 inches; such a telescope, in fact, as you see frequently at watering-places for observations of ships and sea-side objects, but such as was perhaps never before used for the discovery of a planet. But this telescope was one of which the young astronomer might well be proud. It, or a smaller one of 19 lines aperture, which it replaced, was purchased with the money obtained for one of two copies which he had made at Florence of the portrait of Galileo. Never, perhaps, were great results accomplished by so small means as were at his disposal; and if this be, as is generally believed, an attribute of genius, M. Goldschmidt may fairly claim the admiration which is due to it. A telescope of 2 inches aperture, placed in the window of a garret forming the sleeping apartment of the astronomer, is made, by judicious handling and severe scrutiny of the Berlin maps, to discover one of a class of objects which it taxes to the utmost the astronomers of Greenwich to observe, when found, with the great transit-circle. But better days were in store for the Astronomer. His next four discoveries — those, I mean, of *Pomona*, *Atalanta*, *Harmonia*, and *Daphne* — were made with a larger telescope; how obtained I am not able to tell you, excepting that it was certainly out of the fruits of his industry in his professional employment as an historical painter, and by the practice of the most rigid economy. Well, Gentlemen, this telescope, undoubtedly an improvement on the preceding, was of 30 lines, or $2\frac{3}{5}$ inches aperture, and with this still apparently inadequate instrument did he discover four additional planets. The remaining eight were discovered with a telescope of 4 inches aperture, and I wish I were enabled to give you some information about its acquisition. Let it suffice that none of them were mounted equatoreally, but that, in the greater number of instances, they were pointed out of a window which did not command the whole of the sky; and I now leave you to form your own opinion of that fertility of invention and resource, that steady determination to conquer apparently insurmountable difficulties, the untiring industry, and the never-failing zeal, which realised such splendid results with such inadequate means.

I purposely kept out of sight all these interesting circumstances in the personal history of M. Goldschmidt, till I had led you dispassionately to consider the real value and merit of his discoveries independently of them, and his absolute superiority over his formidable rivals in the race of discovery;

because I consider it as a rule to be adhered to with the utmost tenacity in the bestowal of your Medal — a rule from which, indeed, your Council has never deviated — that the merit and the importance of the astronomical work which we propose to crown with our award must be considered apart from all personal considerations. Indeed I may say with perfect truth, that, to the best of my knowledge, no member of the Council, including myself, was aware of these circumstances; we knew solely that by profession M. Goldschmidt was an artist, but of his peculiar struggles and difficulties in achieving so great astronomical success we were all profoundly ignorant. But surely, Gentlemen, after that we have performed with the utmost rigour and impartiality our duty as astronomers, we may now at least indulge our natural feelings as men, and show before Europe, and especially before France, how we honour the character of him who, both in his scientific and his private capacity, has added to her fame, and who deserves from her such recognition as she so well knows how to give to her illustrious citizens.

It is now time that I turn from the consideration of the discoverers of these new members of our solar system to the results of their discoveries; and, in the first place, I wish I could tell you that through their means we had arrived at some definite theoretical conclusions regarding their origin and their mutual connexion with each other: but such is far from being the case. Isolated from all the greater planetary bodies, they form a ring of planets evidently belonging to a distinct system, and, it may be, having their origin in some great catastrophe countless ages ago. The idea of Olbers, that they were the shattered fragments of some large planet which once glittered in the sky like *Mars* or *Jupiter*, was poetically grand; and the hypothesis, in connexion with Bode's empirical law, was so plausible that even now many cling to it, and try to force facts into accordance with it. But the greater the number of discoveries, the less appearance of truth is there in the hypothesis. In a recent number of the *Nachrichten** is a notice of a paper by Mr. Newcomb, an American astronomer (published originally in the American *Philosophical Transactions*), in which he has arranged and discussed twenty-five of the orbits with reference to the hypothesis of a shattered planet, and he finds nothing whatever to justify this supposition. On this head let us be contented that Bode's law has done its work well: it set astronomers on the true trace for the discovery of the members of this singular system, and it helped to discover *Neptune*. Whether there be a correct law of planetary distances, of which this is a first approximation, or whether the planets have been placed arbitrarily at distances subject only to the ultimate laws of the Almighty Architect,

* No. 1288.

whose designs are unfathomable by us, remains still to be proved. Let it suffice, that in every new discovery we see an additional proof of the wonderfully simple and comprehensive law of gravitation; and that the filmy, vaporous masses of the comets, and these minute atoms, revolve in their appointed courses as unerringly as the ponderous masses of the larger planets.

There is one more consideration which I must lay before you, and it bears the same relation to the subject-matter of this address that the charitable appeal at the end of a sermon does to the theological arguments which may have preceded. I have to ask your assistance and advice with regard to these small members of the solar family. One has already, for want of needful care, gone astray, and, it is to be feared, will not be brought back to the path of rectitude in her orbit: *Daphne* is lost, and, as the numbers increase and the difficulty of providing for the observations and for the computation of the orbits increase in the same proportion, we must fear that other losses will follow, and the results of some of these interesting discoveries be neutralised. This difficulty is not felt now for the first time; and indeed, some few years ago, when the number of planets was comparatively small, an arrangement was made by the directors of several European and American Observatories to divide among them the labour of observing, each Observatory making itself responsible for a definite number of the planets, according to its observing force and instrumental equipment. I am not quite sure that this organisation is understood to exist at the present time: some members of it, at least, have ceased to take part in the operations, and the immense increase of the number of objects to be observed of itself makes it necessary that it should be reconstituted.

But the deficiency of observers does not form the chief difficulty of the case. By judicious arrangements, an association similar to that which I have mentioned, but established on a more permanent plan, and with officers charged with the duty of attempting to keep it in a condition sufficiently vigorous to meet all exigencies arising from the progress of discovery, could be formed without much difficulty; and I have no fear but that the increase of instrumental means and of observing force will, on the whole, keep pace with the progress of discovery. Several large telescopes are mounted equatoreally, both in Europe and America, which do but little work, and they could not be better employed than in taking a share in the operations of the proposed association. The deficiency of observing power is, therefore, not an insuperable difficulty: the difficulty is rather to provide systematically for the calculation of the orbits, and the computation and distribution of ephemerides for the use of the observers, as soon as possible after the discovery of a new planet.

It is well known that the Astronomer Royal undertakes

the meridian observations of all those planets which are visible at Greenwich; and this is a most valuable contribution on his part, and a most liberal interpretation of his duties in advancing speculative astronomy. But the difficulty of finding the requisite ephemerides of the daily motions of the planets so embarrassed the observers at Greenwich as at one time to to render useless at least half of the observing labour that had been expended. This induced him, as you may remember, to issue a circular addressed to the directors of the chief European Observatories, begging their assistance either in sending recent observations of newly-discovered planets or ephemerides of their motions. This circular was partially successful, and since the time it was issued much less labour is thrown away by the observers.

Still, something more is requisite to meet the present requirements; and all that I can suggest at present is, that the planetary association, when formed, should take the same charge of the computation of orbits and ephemerides as of the observation of the planets. Some Observatories which are not sufficiently well equipped to provide for observations might undertake the discussion of the early observations made by others, while the association might issue specimens of blank forms for the computations, which would make it practicable to put large masses of the work into the hands of comparatively inexperienced computers.

This, however, is not the time to enter into details respecting the plan which I have sketched; and, indeed, a very great deal of thoughtful consideration and discussion must take place before any plan can be devised sufficiently prudent to secure for the present the co-operation which is needed, and to make the proposed association available as a permanent institution.

In the discharge of the duty which has devolved upon me, I have thought it necessary to lay before you the necessity of some speedy mode of vigorous action, being certain that the currency given throughout the world to our Proceedings will at least make it probable that the matter may be taken up by some persons more competent to deal with the difficulty than I can pretend to be.

But, Gentlemen, such is the rate of progress of astronomical discoveries, and so prolific is each individual discovery as containing the germs of many others, or, what is the same thing, so inextricably mingled are the various branches of astronomical research, that our responsibilities do not end with the consideration of any one branch, such as that of planetary discoveries, which we have been considering. The same general survey, or mapping of the Northern heavens, which gave rise to these discoveries, has also advanced, and indeed almost created, another important branch of research, namely, that of variable stars. The number of known variables is now so

rapidly increasing, that provision for the systematic observation of them, and for the discussion of the results, will soon be as necessary as in the case of the small planets. Then, again, the Sun himself presents a rapidly increasing source of interesting matter for research and speculation. The same may be said of the Moon and the great planets, both as regards the analytical investigations relating to the perturbations of their orbits and to their physical peculiarities.

Thus, in whatever direction we turn our eyes, the same remarkable activity and marks of progress are presented to us. Powerful telescopes are continually directed to the heavens in every quarter of the globe, handled by men eager for discovery and intellectually competent to turn to the best account that which they may have discovered or seen. And as, on the earth, each small and apparently rude element teems with organised life, and gives ample employment to the microscope, so do the regions of infinite space, laid open to us by the telescope, in the heavens, teem with unexhausted wonders, which only require the intelligent mind and the keen eye of the astronomer to discover. The works of creation are as boundless at one extremity as at the other. Planets countless in numbers, but which no man has ever seen, probably still roll on in their silent orbits; stars, the centres of other systems as grand and as boundless as all that we behold on a winter night, offer mysterious peculiarities, only waiting for the record of future astronomers; phenomena still more curious than any yet revealed to us are still waiting their scrutiny and development.

Astronomy, after all, is a young science in all the aspects under which we are regarding it; and even at the beginning of the present century, after all the wonderful discoveries of the elder Herschel, not one of the subjects which I have touched on in this address would have found a place. There is no fear for the future, and we may, in anticipation, envy to our descendants the accumulation of facts and the comprehensive grasp which they will have of the science of the visible universe compared with ourselves. It is sufficient for us to know, as astronomers, that there is work — good and well-repaying work — remaining for us to do, and, as Christians and as men, to recognise the scantiness of our knowledge compared with the wonders of creation; and to exclaim with all humility, when we look up intelligently into the starry heavens, "Lord, how manifold are Thy works; in wisdom hast Thou made them all."

(*The President, then delivering the Medal to Admiral Manners, addressed him in the following terms*):—

Admiral Manners, — I request that you will have the goodness to transmit to M. Goldschmidt this medal, and to

accompany it with the best wishes of the Members of this Society for his future happiness and prosperity. Tell him how we sympathise with him in his early struggles, and how we admire the energy and devotion which enabled him to accomplish so much with means so utterly disproportionate; and assure him, finally, of the interest with which we shall watch his future career, and of our hope that he may ultimately be enabled to devote exclusively to Astronomy those talents which, under such disadvantageous circumstances, have produced such important results.

The Meeting then proceeded to the election of the Officers and Council for the ensuing year, when the following Fellows were elected:—

President:

John Lee, Esq. LL.D. F.R.S.

Vice-Presidents:

G. B. Airy, Esq. M.A. F.R.S. Astronomer Royal.
Rev. Robert Main, M.A. F.R.S.
Augustus De Morgan, Esq.
Rev. C. Pritchard, M.A. F.R.S.

Treasurer:

Samuel Charles Whitbread, Esq., F.R.S.

Secretaries:

Richard C. Carrington, Esq. F.R.S.
Warren De La Rue, Esq. F.R.S.

Foreign Secretary:

Admiral R. H. Manners.

Council:

J. C. Adams, Esq. M.A. F.R.S.
Arthur Cayley, Esq. M.A. F.R.S.
Richard Farley, Esq.
Rev. George Fisher, M.A. F.R.S.
Charles Frodsham, Esq.
James Glaisher, Esq. F.R.S.
Richard Hodgson, Esq.
W. S. Jacob, Esq.
Admiral W. H. Smyth, K.S.F. D.C.L. F.R.S.
Charles B. Vignoles, Esq. F.R.S.
Charles V. Walker, Esq. F.R.S.
Rev. Thos. Wm. Webb, M.A.

Discovery of a New Minor Planet.

A letter has been received from M. De Gasparis, dated Naples, 11th February, 1861, announcing his discovery of a new Planet, of the brilliancy of a star of the 10th magnitude. The position is

	Naples M.T.	App. R.A.	App. Decl.
1861, Feb. 10,	$14^h\ 33^m\ 18^s$,	$11^h\ 11^m\ 42^s{\cdot}5$,	$+5^\circ\ 18'\ 49''$.

The comparison was made with 120 Weisse, hora xi., the adopted mean position of this star for January 1861 being

R.A. $11^h\ 8^m\ 28^s{\cdot}93$, Decl. $+5^\circ\ 14'\ 24''{\cdot}4$.

The motion of the Planet in Declination is very small; that in R.A. is about -42^s daily.

ERRATUM.

Vol. xxi. p. 8, *for* June, *read* July in every place where it occurs.

Printed by STRANGEWAYS and WALDEN (late G. Barclay), Castle St. Leicester Sq. and Published at the Apartments of the Society, March 9, 1861.